DAILY EDITION
Nineteenth Year

Railway Age

AND RAILWAY REVIEW

Railway Engineering and Maintenance Railway Signaling

CHICAGO, THURSDAY, MARCH 8, 1928

RAILWAY AGE:—Published weekly by Simmons-Boardman Pub. Co., 30 Church St., New York, N. Y. Subscription price: United States, Canada and Mexico, $6.00; foreign countries (not including daily editions), $8.00. Entered at East Stroudsburg, Pa., as second-class matter.
RAILWAY ENGINEERING AND MAINTENANCE:—Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copies, 35c. Entered at Chicago, Ill., as second-class matter.
RAILWAY SIGNALING:—Published monthly by Simmons-Boardman Publishing Co., at 105 W. Adams St., Chicago. Subscription price: United States, Canada and Mexico, $2.00; foreign countries, $3.00 a year. Single copy, 35 cents. Entered at Chicago, Ill., as second-class matter.

Railway Age

Railway Engineering and Maintenance Railway Signaling

DAILY EDITION

Vol. 84 March 8, 1928 No. 9C

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Action in Exhibits

ONE OF the most noticeable features of the show at the Coliseum this year is the amount of action in the exhibits. The manufacturers are to be congratulated on their ingenuity in this regard. The tendency is a laudable one and tends to stimulate interest to a greater degree than heretofore. Most advertising experts agree that the eye is the best medium for advertising purposes and action attracts the eye. The flashing lights, the movement and the action are helping to make the present show a record-breaker in all respects and will do much to insure its continued growth.

First Aid in Yard Design

THE Committee on Yards and Terminals has contributed a valuable piece of work by including, as a part of its report, a design for a large hump classification yard, which, together with explanatory matter, was presented as information. The committee recognizes that while it is a comparatively simple task to lay out a typical yard without having any particular location in mind, such a plan will rarely adapt itself in its entirety to the restrictions which may be imperative for individual yards, and hence has devised a yard which conforms to general principles of design and which may be modified to fit particular requirements or locations. The principles of design which led to the plan of the yard are set forth in great detail by the committee and in themselves will be of great assistance to the engineer who is called upon to provide facilities of this nature. All elements of operation are considered and full reference is made to recent developments for accelerating movements and cutting down the cost of operation by the installation of car retarders and of pneumatic tubes for handling waybills as well as providing for the flood lighting of the yard.

Believe It or Believe It Not

IT is claimed by a member of the association who has attended the last ten annual conventions of the A. R. E. A., that in all of these pilgrimages to Chicago, he has never been found away from the convention headquarters or the Coliseum, or off the beaten path between these two points, except on some special excursion or tour of inspection sponsored by the association. The only parallel that we know of worthy of comparison with this record, is that of the New Englander who is said to have passed through New York City weekly for the last 20 years en route from New England to Jersey City, N. J., without once having come to the surface. Not knowing the basis for these claims, we feel, of necessity, that both of them should be placed under the heading, "Believe It or Believe It Not," and yet we cannot overlook favorable comment on the record of an association member who apparently has been so loyal

to both the association and his own road. We agree with the idea implied by this member that the two most important places in Chicago for the members during the convention are the convention headquarters and the Coliseum. Railroad men who come to Chicago at this time have not only a responsibility, but a rare privilege in the opportunity to hear the committee reports and the discussions which follow, and to see the exhibits of the N. R. A. A., at the Coliseum, exemplifying the latest developments in the field.

The Menace of Corrosion

SUBJECTS come and subjects go but some go on forever. Among those to be included in the latter class, according to the report of the Committee on Track, is that embracing the cause and effect of brine drippings. In so far as "cause and effect" are concerned the facts are rather well established, but as to the solution of the problem, we seem to be as much in the dark now as we were when this subject was first assigned for investigation and report years ago. While the current report is not specific as to this particular point, it is to be inferred that the committee sees little hope of a remedy through the enforcement of regulations covering the use of brine retainers on cars charged with salted ice and, judging from the long story of the efforts to secure the enactment and observance of such regulation, this conclusion is justified. While considerable attention is now being given to the application of other means of obtaining low temperatures in cars, development in this field is still in the highly experimental stage. It is, therefore, not to be expected that relief from this source will come very soon, so it is clear that the railways must contend with the ravages of brine drippings for some years to come. The losses involved are of a sufficient magnitude to warrant concerted attention to the problem; indeed, it has been contended by some that corrosion from this and other causes is responsible for the detruction of railway property which is so large in the aggregate that the time and efforts of a special committee could well be occupied with this one subject alone.

"Presented as Information"

AMONG the measures proposed to speed up the work of the A.R.E.A. on the convention floor has been that of restricting discussion to reports which are presented for adoption in the Manual of Recommended Practice. While this would undoubtedly expedite matters, there is grave danger that such action would deprive the members as well as the committees themselves, of much constructive criticism and discussion of distinct aid in formulating reports for final adoption. Indeed, some of the committee work is a continuing study of fundamentals, the application of which is in a constant state of flux. On such subjects the work of the committee necessarily must be to collect the modifying data as they become available and to present them "as information" for the benefit of those who have to deal with the particular problems considered. The work of the committee on Economics of Railway Location is a case in point. If it were necessary to consider only the fundamentals, there would be no need of the committee, since Wellington's monumental treatise on The Economic Theory of Railway Location leaves little to be said as to the basis for such work. But when the engineer attempts to apply Wellington's principles without being fully informed as to the many developments in motive power and rolling stock, as well as to the improvements in signaling and the control of turnouts he is distinctly "out of luck." All this information is available in one place or another but its collection is lightened by the labor of the committee in embodying it in its reports, and its value is enhanced by a full and free discussion on the floor of the convention.

The Dinner, an Opportunity

ONE of the outstanding developments of the A. R. E. A. in recent years has been the increased emphasis that has been placed on the annual dinner. Prior to 1924, the interest had declined from year to year until only 252 were present in 1923. During the following year one of the features to which E. H. Lee gave special attention as president was the dinner and through his initiative the attendance was brought up to 651 in 1924. In the following year this number was increased still further to 706, again in 1926 to 775 and last year to 925. The number attending last evening approximated 1,000.

In this period of five years the dinner has been transformed from one attended only by loyal members from a sense of duty to one where tickets are in demand. Yet, splendid as this progress has been, it is only the beginning in the development of the ultimate possibilities. The annual dinner of the Railway Business Association in New York has become the outstanding event of its character in railway circles in this country, with more than 1,500 attending. The possibilities for the annual dinner of the A. R. E. A. are equally great. Although Chicago is the largest railway center in the country, there is no similar railway dinner in the central west. Furthermore, the dinner is held at a time when more than 2,500 railway and railway supply men are in the city for the convention and exhibit. The progress that has been made in the last five years indicates that the A. R. E. A. is rapidly awakening to the importance of this dinner as a means of emphasizing its place in railway and business circles and also as an opportunity to broadcast a constructive railway message to the country at large that need be second in importance only to that of the Railway Business Association, if indeed to it.

The Past Is Secure— What of the Future?

L. A. DOWNS reviews railway history, describes railway achievements and discusses railway problems with an unusual background of training and experience. He was for years an engineering and maintenance of way officer. He was subsequently for years an operating officer. He has now served as the president of two railroads. To the broad knowledge of the technique of railroading, he adds the qualities of statesmanship needed for coping with the great modern problems of personnel and public relations. As was to be expected, therefore, his address at the dinner last night was interesting, broad and constructive as a survey of the railway past and present and anticipation of the future.

The historical facts cited by Mr. Downs make a remarkable story of the past development of the plants and performance of the railways, and of their contribution to the creation of the industrial, commercial

and social United States of the year 1928. The railway pioneers had many physical and economic obstacles to overcome, and they overcame them all. As Mr. Downs indicated, railway officers of the more recent generation have had even harder problems to solve because of restrictions under which they have had to work—restrictions imposed by the physical plants themselves, but especially by changed labor conditions and government regulation of rates and profits. Thus far, they have solved their problems in a way that has been highly beneficial to the nation, although not so satisfactory from the standpoint of those who have furnished the capital which has made possible the expansion of the railroad plant and the enormous operating economies that have been effected.

In view of much experience during the last twenty years, and of some existing conditions, a fighting spirit as well as one of optimism is required to enable railway officers to look forward to such progress in the railroad field in the future as that in the past which Mr. Downs so well summarized. In order to enable them to continue to contribute to the public welfare on the same scale as heretofore, they will have to struggle successully against the powerful pressure for advances in taxes and wages and reductions of rates which constantly tends to make net earnings inadequate and thereby unduly curtail the investment of capital, although it is the only means of which continued improvements in service and economies in operation can be assured.

The progress the railways have made within recent years, in spite of formidable obstacles, has been very great, and in view of past experience it seems reasonable to anticipate that it will be continued. But whether it will or will not be will be determined mainly by the efforts railway officers from the highest ranks down to the lowest, make to assure its continuance. Boldness and skill in making capital expenditures and improving operating methods; concession of reasonable working conditions and wages to labor, but strong resistance to unreasonable demands from that source; firm and courageous insistence upon fair and constructive regulation; constant education of employees and the public regarding what is necessary to railroad development and transportation progress— for these railway officers must rely upon themselves; but, given these, the "railroad problem" will continue to be solved, however dubious the outlook may seem at times.

Have We the Answer?

THE REMARKS of President Brumley with respect to convention procedure in his address Tuesday morning, representing as they did the conclusion of the board of directors, closed an important chapter in the affairs of the association, for it is many years since anything relating to the association, *per se,* has been so actively discussed by its members. The conclusions reached are based on an exhaustive study by a special committee, and are clearly in accord with the wishes of a majority of the membership. However, there are good reasons to believe that this subject will be brought to the front again, that other special committees will be appointed to investigate it and that other special reports will be presented. The problem which gave rise to the current controversy had its origin in the enviable growth that the association has enjoyed, and as there is every reason to believe that the association will continue to grow, problems incident to increased size and expansion in the duties of the association, are sure to present themselves.

The membership of the American Railway Engineering Association may be roughly divided into two primary groups. On the one hand there is the large class of members, including men of all ranks from division engineer to president, whose work is primarily administrative and calls for a broad knowledge of all phases of railway engineering. On the other, is the smaller group composed of specialists among whom are included bridge engineers, signal engineers, engineers of design, engineers of water service and timber treatment, and those others who are assigned to special investigations of intricate subjects.

Men of the first group are anxious to keep abreast of developments in all fields and are therefore insistent upon a plan of convention procedure which will enable them to sit in on the discussions of all committee reports. Men of the second group on the other hand, feel that advancement in their specialized fields demands a concentration of the interest and energy of men whose time has been occupied primarily in specialized fields and who are therefore particularly qualified to discuss them. They may not be agreed as to whether such a discussion should be confined to the deliberations of committees or be given broader scope in sectional meetings, but, in a certain measure at least, they are not in sympathy with a discussion of intricate subjects on the part of those who are not particularly qualified by training or experience in the restricted field.

This is clearly brought out in the views quoted by President Brumley from the report on convention procedure which is to be presented in full today. Thus, it is held by some that greater refinement of committee work through the concentration of specialists on committees obviates the necessity for an extended, critical discussion of committee reports on the floor of the convention. This raises two questions: (1) Is it possible to include on the committees all members who are specially qualified for service so that all such men may have a hearing of their views and have a real part in shaping the committee reports? (2) If discussion on the floor of the convention is not for the purpose of conducting a critical review of the work of the committees, what purpose is it to serve?

It is not beyond the bounds of reason to presume that the first question may be answered in the affirmative at the present time, in so far as it concerns the work of committees dealing with more highly technical subjects. But if the association continues to grow, the time will come when the satisfactory answer to this question will raise a real problem.

The second question, that of the primary function of discussion, finds its answer in the object of the association—that of "the advancement of knowledge pertaining to the scientific and economic location, operation and maintenance of the railroads." Surely discussion on the floor of the convention has an important function, for regardless of how carefully committee reports are prepared they cannot receive the stamp of approval without presentation at the convention and unless opportunity for full and adequate discussion is afforded such approval will become purely perfunctory.

But apart from the function of the convention as the means of reviewing the committee reports it serves as a means by which the committee may "sell" the value of its work to those who are to carry out its findings in actual practice. It serves as an opportunity to clarify obscure points. It may bring to light information which the committee, in spite of conscientious investigation, has overlooked.

CONVENTIONALITIES

One of the visitors expressed his disappointment at not having seen some of the "nude devices" which he understood would be on exhibition at the Coliseum.

* * *

The senate Committee on Interstate Commerce voted 10 to 7 against recommending the confirmation of Commissioner Esch's appointment by the senate.

* * *

The state of North Carolina is being signally honored this year. The presidents-elect of both the A. R. E. A. and the N. R. A. A. are native sons of that state. W. D. Faucette was born at Halifax, N. C., on June 27, 1881, and A. L. Greenabaum was born at Wilmington, on January 20, 1880.

* * *

A new feature was injected into the activities of the Water Service committee yesterday in the form of an informal luncheon held at 12:30 p. m. which was attended by 32 members and guests including particularly Mr. Vardon, in charge of water service on the Northwestern railways of India.

* * *

B. R. Leffler, bridge engineer, New York Central, deserves great credit for his courage and determination. Mr. Leffler is attending the convention on crutches, after spending several months in bed as a result of injuries to his legs received in a motor car accident.

* * *

Many of the prominent delegates to the convention have become patrons of the picture-frame industry recently. The reason is the issuance by the association of 180 diplomas for merit to engineers who served their railways and their profession with distinction during the Mississippi flood last year. The wording of the diploma is as follows: "In appreciation of distinguished and meritorious services rendered in rescue and relief work during the Mississippi Valley Flood of 1927, this token of appreciation is awarded on behalf of the American Railway Engineering Association."

* * *

It is a little known but interesting fact that in the days when A. J. Earling was president of the Chicago, Milwaukee & St. Paul, the card index covering location maps, contained one card carrying this surprising announcement: "Defiance to Earling." Almost always this caused consternation among the engineers who saw it, their first thought being that this must be extreme disrespect to the president. This was not the case, however, since the card merely indexed a prosaic location map covering the territory between Defiance, Iowa, and Earling, two stations on the C. M. & St. P.

* * *

Look Closely at the Man Second from the Left, Who Is None Other Than President-Elect Greenabaum of the N. R. A. A., in the Days When He Worked

* * *

Ten Years Ago—Two Days After the Capture of St. Mihiel—Reading from left to right: W. G. Arn, assistant chief engineer, Chicago terminal improvements, Illinois Central; N. L. Howard, president, Chicago Great Western; C. L. Whiting, superintendent terminals, Chicago, Milwaukee, St. Paul and Pacific, and V. H. Hagelbarger, trainmaster, Chicago, Rock Island & Pacific

That the A. R. E. A. has been a prime force in railway affairs is indicated by a check of the careers of the surviving charter members. There are 70 of these, and no less than 11 of them are or have been railway presidents, while 4 are or have been vice-presidents. This includes two members who are chairmen of the boards of their railways, namely: S. M. Felton, Chicago Great Western, and W. G. Besler, Central of New Jersey. The charter members who are now presidents include: W. B. Storey, Atchison, Topeka & Santa Fe; L. A. Downs, Illinois Central; W. J. Harahan, Chesapeake & Ohio; E. H. Lee, Chicago & Western Indiana; F. H. Alfred, Pere Marquette; W. A. McGonagle, Duluth, Missabe & Northern, and R. H. Aishton, American Railway Association, in the order of their membership. In addition, W. S. Kinnear was formerly president of the Kansas City Terminal, and Howard G. Kelley, of the Grand Trunk. The vice-presidents include: L. C. Fritch, Chicago, Rock Island & Pacific; C. H. Ewing, Reading; H. R. Safford, Missouri Pacific, and W. J. Wilgus, formerly vice-president of the New York Central.

The Board of Direction of the A. R. E. A. in session Monday at the Palmer House

Reading Around the Table, Left to right: J. V. Neubert (N. Y. C.), W. H. Kirkbride (S. P.), J. L. Campbell (S. P.), C. E. Johnston (K. C. S.), J. M. R. Fairbairn (C. P. R.), E. H. Fritch (A. R. E. A.), D. J. Brumley (I. C.), F. J. Stimson (Penna.), W. D. Faucette (S. A. L.), L. Yager, (N. P.), G. D. Brooke (C. & O.), R. H. Ford (C. R. I. & P.), W. J. Backes (B. & M.). Omitted from photograph—J. E. Armstrong (C. P. R.), and A. Montzheimer (E. J. & E.).

A. R. E. A. Meeting Well Attended

Extended discussion of seven committee reports brought out much valuable information

THE LARGE attendance which characterized the opening session of the A. R. E. A. convention was evident throughout both sessions yesterday. The morning session was called to order promptly at nine o'clock by President Brumley and reports were presented during that session and the afternoon session by the committees on Electricity; Signals and Interlocking; Yards and Terminals; Economics of Railway Operation; Economics of Railway Location; Economics of Railway Labor and Track.

Report on Signals and Interlocking

W. M. Post (Penna.)
Chairman
W. E. Boland (S.P.)
W. J. Eck (Sou.)
W. H. Elliott (N.Y.C.)
G. E. Ellis (A.R.A.)
P. M. Gault (M.P.)
J. V. Hanna (K.C.T.)
J. C. Mock (M.C.)
H. G. Morgan (I.C.)

W. M. Post

F. W. Pfleging (U.P.)
Vice-Chairman
J. A. Peabody (C.& N.W.)
A. H. Rudd (Penna.)
Thos. S. Stevens (A.T.& S.F.)
E. G. Stradling (C.I.& L.)
W. M. Vandersluis (I.C.)
R. C. White (M.P.)
F. B. Wiegand (N.Y.C.)
Leroy Wyant (C.R.I.& P.)

THE COMMITTEE submitted reports on the following assignments:

(1) Continue study of automatic train control—collaborating with Committee V—Track and Committee XIV—Yards and Terminals (Appendix A).

(2) Continue study on automatic manual and non-operative signals for highway crossing protection, collaborating with Committee IX—Grade Crossings (Appendix B).

(3) Prepare and submit as information a synopsis of the principal current activities of the Signal Section, A. R. A., supplemented with list and reference by num-

ber of adopted specifications, designs and principles of signaling practice (Appendix C).

The committee recommended: 1. That the report in Appendix A relating to the development in automatic train control since the last report be accepted as information. 2. That the report in Appendix B relating to development in highway crossing protection be accepted as information. 3. That the report in Appendix C, giving a synopsis of the principal activities of the Signal Section, A. R. A., together with a list of adopted specifications, designs and principles of signaling practice, be accepted as information.

Appendix A included abstracts of the reports of the Interstate Commerce Commission's final inspections of automatic train control installations on which reports have been issued in the past year. These abstracts included a brief statement of the limits of the territory, the equipment used, and a list of the exceptions and maintenance requirements. The reports were published currently in the *Railway Age* and *Railway Signaling.*

Appendix B—Study on Automatic Manual and Non-Operative Signals for Highway Crossing Protection

Some of the most important changes in the highway crossing protection situation in the past year are as follows:

1. The Signal Section, A. R. A., revised and finally adopted the revision of Requisite 2, previously approved in July, 1925, which now reads as follows:

"2. *Location*—The railroad standard highway crossing sign and the signal shall be mounted on the same post. Either a signal of the flashing light type or one of the wig-wag type may be used, but both should not be placed on the same post. No lights, markers or signs, other than those provided in the requisites, shall be placed on this post."

2. While recognizing that in most states the type, location and method of operation of the signals are subject to the requirements and approval of the state commission, it is the opinion of the committee that no additional protection is afforded to the occupants of automobiles by the addition of bells. * * *

The committee recognizes the fact that bells, to be of use in stopping all classes of automobiles, must usually be so loud as to constitute an annoyance, and should not be used for this purpose; but they may be a valuable auxiliary to the visual signals at crossings used by considerable numbers of pedestrians, such as those located near factories and schools. It is suggested that where such bells are provided as auxiliaries, one be installed which in some states is known as the "pedestrian" bell, and is sufficiently loud to warn pedestrians or drivers of horse-drawn vehicles, but is not as loud as the recommended bell and is, therefore, less annoying to people in the vicinity. In short, bells should be considered as an adjunct rather than a requisite and only be provided in exceptional cases.

Action of State Commissions

The Ohio Public Utilities Commission has held hearings on the question of uniformity of highway crossing protection, particularly the utility of electric signals, either wig-wags or alternately flashing lights, for the protection of crossings in place of watchmen.

The Illinois Commerce Commission has also held hearings on the proposition of standardizing either on the wig-wag or the alternately flashing lights, and on the location of such warning signals, whether at the side or in the center of the highway. The Pennsylvania and New York commissions have standardized on the alternately flashing lights.

The California commission has issued a definite order prescribing that the wig-wag type automatic flagman shall be the type of protection used for highway crossings, and that the banner shall be painted red.

The Board of Railway Commissioners of Canada has established as standard the three-position wig-wag, the third position indicating that the device is out of order.

In Delaware where there is no public service commission, the highway department requires that the signals be located in the center of the highway and in several cases has agreed to widen the highway if necessary for this purpose.

In Pennsylvania, the Department of Highways desires the signals at the side of the road, but, under a recently executed agreement, the Public Service Commission will determine the location.

In Illinois the highway department desires the signals located at the side of the road, and in New York and New Jersey the Board of Public Utility Commissioners prefers the signals in the center of the street—here again the highway department wishes them at the side of the road.

In fact, with the exception of Delaware, the highway departments in a number of the states object to obstructions in the middle of the highway.

The executive ruling handed down by the Public Service Commission of Pennsylvania is as follows:

"The Department of Highways of the Commonwealth of Pennsylvania, The Public Service Commission, and such railroad companies as may become parties hereto, have agreed upon the establishment of a uniform type of warning signals, as follows:

(1) When automatic warning signals are authorized by the Public Service Commission at crossings of state highways with railroads, the railroad companies shall erect a signal on each side of the railroad which, actuated by approaching trains, shall present to the highway traveler the appearance of a horizontally moving red light the direction of which shall reverse alternately. The signals are to be erected and function in accordance with the recommendations of the signal division of the American Railway Association approved July, 1925. The railroad companies affected shall install and maintain the signals, and the Department of Highways shall pay one-half of the cost of installation. If the installation is made under contract, competitive bids will be requested by the railroad companies; otherwise detailed estimates of the cost of installation will be prepared, and copies of such bids or estimates will be attached to the request for the Department of Highways' participation in the cost of installation and shall be approved as to acceptability by the Chief of the Bureau of Accidents of the Public Service Commission. Upon the completion of the installation a statement of the actual cost will be forwarded, together with the completion report of the work.

(2) Where a full view of these signals is less than 500 ft. on account of curvature or grade in the highway, an additional signal, consisting of a continuously yellow flashing light, shall be installed approaching the curve or grade, so as to give advance warning of the curve and the railroad; the highway department to erect and maintain such signals, and the railroad company affected to pay one-half of the cost of installation. Copies of bids or estimates of cost will be forwarded and approved as required where installation is made by the railroad companies, and upon completion of the work, certified statements of the actual cost will be forwarded to the railroad companies.

(3) Approaching dangerous curves, due to separation of grade of highway and railroad, where, in the opinion of the chief of the Bureau of Accidents of the Commission, additional protection is necessary, similar continuously yellow flashing lights shall be installed, under the same conditions, namely, the department to erect and maintain, and the railroad company affected to pay one-half of the cost of installation.

(4) The Department of Highways shall not permit the erection of any horizontal alternately flashing red lights on the state highways except for the purpose of indicating the approach of trains at such crossings.

(5) The use of the standard disc approach sign shall be continued and additional ones erected as necessary, and the Department of Highways shall recommend to the township supervisors the erection of these signs on township highways where they are not now in use, such discs to be paid for by the railroad company and erected and maintained by the local authorities.

The plan would tend to the establishment of uniform protection devices at crossings now wholly unprotected and improvements over devices now in use at others, and subject to the following conditions and reservations is approved. This approval (1) shall not be construed to diminish or in any wise change or transfer the primary responsibility imposed on railroad companies by the Public Service Company law to furnish and maintain service and facilities at and over grade crossings that shall be at all times safe to their patrons, their employees and to the public; nor to affect the duty of the railroads to change the protection measures when necessary or proper for the safety of any or all of said classes of persons; (2) is conditioned upon notice being given to the chief of the Bureau of Accidents of this commission of any proposed installation of lights under the arrangement and in sufficient time prior to the proposed installation to enable said chief to make an investigation or inspection with respect to the crossing conditions and the sufficiency of the devices proposed to be installed."

Substantially all the railroads have become parties to this agreement.

4. In a large number of cases the authorities have permitted the substitution of automatic signals for gates, and in a number of cases have permitted the protection of several crossings by electric signals in place of gates, the signals being operated by a crossing watchman centrally located. Such a method of operation possesses economic advantages, while not carrying with it the danger incident to lowering gates directly in front of or upon approaching automobiles.

Such signals have also been installed on a line where there are no passenger trains, and the entire movement is a shifting proposition, switches being located at three places, so arranged that the signals can be operated from either of these places or rendered inoperative at either of the three by trainmen, who are required, before trains or engines use the crossing, to throw on the lights and to extinguish them when the train movement is finished. A bell has been installed for additional warning to the public and as a reminder to the trainmen.

At other locations, where considerable shifting is done and watchmen are on duty at such times, they manually control the highway crossing signals, operating them not only for movements on the main track but for movements on the sidings, restoring the automatic feature when going off duty.

Signals in Lieu of Gates

While most of the railroads have recognized the utility of highway crossing signals operated automatically, only a few have developed their manual application to anywhere near the extent possible through the remote control of these signals by a watchman at a central point.

Some installations have been made where there is no highway crossing watchman, but where the approaching train sets the city traffic signals at stop and causes it to display this indication until the train reaches the crossing.

Several combinations have been installed for the joint operation of the city traffic signals by the traffic officers, by railroad watchmen, or by trains. Such joint control is also entirely feasible, utilizing the standard railroad crossing signals instead of the city signals for this purpose.

At Orlando, Fla., signals protecting 23 street crossings are controlled from five cabins, the local conditions being such that automatic protection was impracticable. They are operated between the hours of 6:00 a. m. to 10:00 p. m., 16 hours a day. During the 8 hours the signals are inoperative, the lever controlling each set of signals is in the "off duty" position and a flashing yellow light is displayed. The indications are the same as those at street intersections of the city, red for Stop; yellow and a bell for change of indication, and green for Proceed. The bell does not ring when the lever is in the "off duty" position. The city officials agreed to elimination of crossing gates then protecting crossings if the Atlantic Coast Line would install traffic light signals at crossings of its line and the city streets, and that if the traffic signals conformed to those of the city, police supervision would be given, which was ably proved when a reckless driver who ran into and destroyed a signal was heavily fined, sentenced to a road term and forced to pay the cost of replacing the signal. They have also fined other drivers for disregarding the signals. However, after the first two or three weeks the signals were in service, no violations have been reported. With such co-operation from the police department, it can be readily seen that the crossings in Orlando are going to be made safe, or could be made safe in any other city. The night or day speed restriction through the city is 25 m. p. h.

It is questionable whether it is good policy for the railroads to give a "Go" signal to highway travelers over the crossing with the railroad.

Red Lanterns for Flagmen

5. The Safety Section of the A. R. A. has suggested that crossing watchmen, provided with red lamps shielded from the railroad, swing these lamps across the highways when a train is approaching, in order that this lamp, under present practice held stationary, might be distinguished from an automobile tail light or some other stationary red light.

The committee is very much in favor of this proposition, as such action on the part of the watchman would provide a signal almost identical with our recommended highway crossing signals, namely, have "the appearance of a horizontally swinging red light and/or disc." In our opinion, the more closely we can approximate the standard, the more confusion will be eliminated.

If this were universally done, it seems to us that it might result in many cases in substituting highway crossing signals for the watchman, which signals, as expressed quite recently by a prominent operating official, "do not go to sleep, do not put in a large part of their time talking to their friends and in fact do not wait for the engine whistle to blow."

6. The location of lights on crossing gates, the kind of light to be installed and the method of operating, perhaps by having them swing or give the appearance of swinging, might well be carefully studied in an attempt to standardize in this important matter and improve present conditions.

7. A number of committees are engaged in this effort at standardization, and there is danger, unless they co-operate, that great confusion will result.

The signs adopted are all yellow with black lettering; the Stop signs are octagonal in shape; the Caution signs triangular, on which are shown words and graphically, curves, street intersections, street crossings, etc.; Information signs are square; the Approach sign to the railroad is the well known "R. R." with the cross, except that the background is yellow instead of white.

8. Various devices have been submitted, varying from the recommended standards of the American Railway Engineering Association and the American Railway Association, some of which undoubtedly have good points, but if uniformity is ever to be attained, it can only be done by adhering to some standard and the elimination of local variations therefrom. The Signal Section, American Railway Association, requisite

provides for a signal giving "the appearance of a horizontally swinging red light and/or disc." This, with the other requisites, except the one cited at the beginning of this report, has been approved by the American Railway Engineering Association and is included in the recommendations of the American Engineering Standards Committee, Sectional Committee for Code on Traffic Signals, which was approved as an American Standard by the main committee November 15, 1927, copy of which is shown in Exhibit A.

In view of the great progress which has been made in standardization, it would appear that it is the duty of the members of this Association to advocate the use of these standards and discourage any variations.

Exhibit A—Code of Colors and Forms for Traffic Signals for Highways and Vehicles is the same as presented in the report of the Signal Section, A. R. A., Committee on Highway Crossing Protection as published on page 560-D9 of the *Railway Age* for March 6.

Discussion

[C. H. Tillett, signal engineer, Canadian National, and chairman of the Signal section, A. R. A., presided over the meeting during the reading of the report on signals and interlocking which was presented by the committee chairman, W. M. Post (Penna.).]

Mr. Tillett: I want to thank the association for the courtesy extended to the Signal section by asking the chairman to preside over a meeting of this association. I am sure it is a courtesy that will go far to help remove the feeling that seems to exist in the Signal section that after all it is only a step-child of Division IV, Engineering, and I believe makes us feel that we are a part of the family.

[Chairman Post presented the information on train control which was prepared by G. E. Ellis, secretary of the Automatic Train Control committee of the A. R. A. The report on the second assignment—Continue Study on Automatic Manual and Non-Operative Signals for Highway Crossing Protection, was presented by A. H. Rudd (Penna.), the chairman of this sub-committee.]

Mr. Rudd: Where the Public Service Commission of Pennsylvania considers protection required, and agrees that sufficient protection is given by the installation of automatic signals, the alternating flashing light signal is made standard by the Public Service Commission. The railroad will erect and pay one-half the cost of erecting, and will operate and maintain. At points where the signal cannot be seen 500 ft. the highway department will erect a yellow flashing light, the railroad will pay one-half the cost of installation and the state will operate and maintain.

New York State has a big bond issue to help out the railroads on grade separation. In New Jersey the grade separation must all be paid for by the railroad. Pennsylvania is the only state so far where there has been agreement and the municipalities or the state will pay a part of the cost of the grade crossing protection. It seems to us there is opportunity for a fair division on the basis that the railroads have not rendered the crossings more dangerous. This condition is the result of the great number of automobiles, and it is only fair that the public should pay part.

On account of the large number of casualties at grade crossings a strong agitation has developed in Washington before Congress and before the Interstate Commerce Commission, for the erection of gates, particularly automatic gates. The Committee on Highway Crossings of the Signal section will investigate that phase of the situation.

[With reference to the use of traffic light signals for the protection of highway or street crossings, Mr. Rudd said: "Any highway crossing signal giving a green 'Go' signal to encourage people to cross is a bad proposition. In the first place, we may have a false clear signal, or if there is any accident the railroad, as we see it, assumes the responsibility by inviting the traveler to cross, and renders itself liable to heavy damages."]

O. E. Selby (C. C. C. & St. L.): Michigan has recently passed a law making it possible to divide the cost of grade crossing protection equally between the state and the railroad.

R. H. Ford (C. R. I. & P.): I do not believe there is any justification for the arbitrary apportionment of cost, but I believe the apportionment of cost will be in about the same condition as the question of the early pronouncements with respect to valuation.

There are 14 standards of railroad standard highway crossing signs in several states, and if there is one thing this committee ought to do it is to find a single standard. This committee should give more study to the economics of this question of apportionment of cost. In view of the remarks of the chairman of the sub-committee, the committee will rewrite that paragraph about the railroad giving the "Go" indication.

Mr. Rudd: The committee is willing to change the paragraph. I believe the Southern has installed a number of red and green traffic signals. If we pass this resolution, we will discredit that practice. There are isolated cases in cities where the city authorities have required the railroads to install the same sort of a signal that they have for their cross streets. In the case of the Pennsylvania, we have arranged in two or three places so that the train will set the signal at stop. After the train has passed, the mechanism for changing the signal to green is set so that the signal may be changed to green by the traffic officer or by the cities' automatic devices, but the railroad itself is not a party to changing the signal to green.

As this report is submitted for information only, it would appear that no motion is necessary on the question, but the committee will make the change so that the sentence will read: "It is not good policy for the railroads to give a 'Go' signal to highway travelers over the crossing with the railroad, and it should not be permitted," as the presentation of opinion of the committee and as information.

Louis Yager (N. P.): I think it is due the committee that the convention register its view on this subject and therefore *I move that the revision suggested by Mr. Rudd be approved as indicating the sense of the convention.*

[*The question was put to vote and carried.*]

[W. M. Vandersluis (I. C.), subcommittee chairman, presented the report on Prepare and Submit as Information a Synopsis of the Principal Current Activities of the Signal Section, A. R. A., Supplemented with List and Reference by number of Adopted Specifications, Designs and Principles of Signaling Practice, which was accepted as information. The committee was then excused with the thanks of the association.]

Report of the Committee on Yards and Terminals

J. E. Armstrong (C.P.R.)
Chairman
J. R. W. Ambrose (Tor.Term.)
Irving Anderson (A.T.& S.F.)
C. E. Armstrong (N.& W.)
H. M. Bassett (N.Y.C.)
E. J. Beugler (Cons.Engr.)
C. H. Blackman (L.& N.)
A. Bousfield (E.& T.Fairbanks)
C. A. Briggs (Dept.of Agr.)
H. F. Burch (D.& H.)
W. A. Christian (C.& W.I.)
C. H. Crawford (D.P.Robinson)
A. W. Epright (Penna.)
O. H. Frick (C.M.St.P.& P.)
E. H. Fritch (A.R.E.A.)
Otto Gersbach (C.J.)
John V. Hanna (K.C.T.)
M. J. J. Harrison (Penna.)
E. M. Hastings (R.F.& P.)
H. O. Hem (Cons. Engr.)


J. E. Armstrong

J. G. Wishart (C.R.I.& P.)
Vice-Chairman
H. C. James, Jr. (N.P.)
D. B. Johnston (Penna.)
H. D. Jouett (Clev.Union Term.)
E. K. Lawrence (B.& O.)
L. L. Lyford (I.C.)
C. P. McCausland (W.M.)
A. Montzheimer (E.J.& E.)
C. H. Mottier (I.C.)
H. L. Ripley (N.Y.,N.H.& H.)
H. M. Roeser (U.S.Bur.ofStds.)
W. B. Rudd (Union Sw. & Sig.)
H. R. Saunders (C.R.I.& P.)
J. E. Saunders (D.L.& W.)
V. I. Smart (C.N.)
C. U. Smith (City of Milwaukee)
C. H. Spencer (I.C.C.)
E. E. R. Tratman (Eng.N.-R.)
J. L. Wilkes (Jacksonville Term.)

THE COMMITTEE submitted reports on the following subjects:

(1) Revision of Manual (Appendix A);
(2) Passenger sub-terminals (Appendix B);
(3) Freight terminals—suggested arrangement of units and description of operations for a generalized type of large hump classification yard (Appendix C);
(4) The proper width of driveways for team tracks and for freight houses (Appendix D);
(5) Scales (Appendix E); and
(6) The proper requirements for practical design and construction of humps in terminal yards.

After collaborating with a number of other committees in the formation of its reports, the committee recommended that the recommendations in Appendix A be approved; that the reports on Appendices B and C be received as information; and that the conclusions in Appendices D and E, be approved and inserted in the Manual Progress alone was reported on subject 6.

Appendix A—Revision of Manual

Under the subject of passenger terminals, the committee made two suggestions for revision. In paragrah (30) the word "preferably" was inserted so that paragraph now reads as follows: The gradient for passenger ramps *preferably* should not exceed 10 per cent, etc. In paragraph (40), the words "6.5 per cent" were changed to "seven per cent" and the paragraph now reads: A gradient of *seven* per cent is the steepest yet used to any extent for trucking ramps.

Under the subject of scales, the committee felt that in view of modern conditions, the three-second minimum weighing time shown in the Manual relative to the motion weighing of cars, was not sufficient. It therefore recommended that, in all parts of the Manual where reference is now made to a three-second minimum weighing time, the value be changed to four seconds.

Appendix B—Passenger Terminals

At the 1927 convention, the Association accepted the report of this committee, on "Points to be Covered in an Agreement Between Companies Participating in a Joint Terminal Project," and directed that the matter be referred to the Committee on Uniform General Contract Forms to prepare an agreement in accordance with the principles therein set forth. Owing to an oversight this was not done in sufficient time to permit including in the report this year.

Co-ordination of Steam Railway and Motor Bus Terminals

A comprehensive survey made as of July 1 and reported in the *Railway Age* of September 24, 1927, shows 52 railways operating more than 800 motor buses transporting passengers over the highways. Of these 52 railways one-half are Class 1 carriers. On 44 of the 52 railways these buses are being used in line service similar to main or branch line rail service. Two-thirds of them are supplementing or extending train service and the balance have replaced discontinued train service. In all these cases, subject only to the divergence of the highway from the railway, the territories served by the motor buses are the same as that now or formerly served by railway trains.

The question of terminals caused little difficulty at first, as the highways of the cities and towns seemed to furnish ample opportunity to stand, load, and unload buses. In many cases the nearest approach to a terminal, in the railway sense, consisted in hiring a vacant store, usually in the center of a chosen district, and fitting it up as a waiting room, with some sort of toilet facilities and sometimes separate facilities for handling baggage.

With the growth of motor traffic, large cities in particular, seeing tremendous prospective congestion, have enacted ordinances forbidding motor buses to use the highway for the purpose of terminal waits. This action, actual or contemplated, has forced the immediate consideration of the problem of sub-terminals co-ordinated with the main passenger terminal, or as an extension service to pick up and deliver passengers nearer to the center of travel, a notable example of the latter being the Baltimore and Ohio service in New York.

Several cities have enacted ordinances taking the motor bus terminal stops off the streets, and the

solution of the problem so presented is as yet in the temporary stage. Waiting rooms located in business buildings are still in use and, for the time being, buses drawn up to the curb, remain only long enough to load and unload, and proceed. Between times they are parked somewhere off the highway.

Examples of the modern idea in motor bus terminals are to be found in California and in Chicago, where the independent operators have gone extensively into the consideration of such buildings and their accessories. An excellent example of the way in which sub-terminals for the handling of highway passengers can be co-ordinated with railway stations is being displayed today by the work of the Boston elevated system in Boston. There is being completed in Boston an electrification for rapid transit purposes of the "Mattapan branch," a line formerly operated by the New Haven in steam service. The right-of-way, with main tracks above the street grade, is being utilized by the rapid transit system, as are the stations formerly used by the steam road. All these stations are in the older residential portions of the city where the streets as a rule are narrow and accommodations for motor buses would be unsatisfactory.

An outstanding example on this branch of a co-ordinated terminal between railway, street car, and bus service is now under construction at Fields Corner, Boston, through the conversion of one of the stations on this Mattapan branch. Using the location of the former railway station as a nucleus about which to work, an effective passenger transfer has been constructed. The main station is on the upper level, as are the two main tracks. High platforms serve these two main tracks. On this same level the street cars come in on one side, pass down an incline, through an underpass under the main tracks, and up an incline to the other side, making a loop circuit for the street cars, with loading platforms between the main line tracks and the street car tracks. The loop connects at either end with the trolley tracks in the streets.

Under the main station, and level with the streets in the neighborhood, is located the enclosed driveway for the buses, wide enough to pass one bus by another. A wide concrete platform is provided along the inner edge of the driveway. This platform connects near either end of the station with a corridor and easy stairways connect with the loading platforms above. Platforms open out at either end on to an existing highway.

This terminal is provided with waiting rooms, toilets, booths for concessionaires, lobbies for employees, etc., but here they are on the main track level, and serve three distinct classes of passengers—the main line traveler, the traveler by surface trolley cars and the traveler by motor bus. It provides a safe and convenient means of transfer from one to the other, all protected from the weather, and yet without costly construction. Any steam railway station, where the main line and the street crossings are at separate grades, could be adapted as a sub-terminal to take care of motor bus or trolley car business in a similar manner.

There is one feature of co-ordination which may be expected to cause some embarrassment. Railway stations, generally speaking, and particularly in the lesser cities, are not located in the sections from which motor bus travel originates. The problem in that case is one of physical connection or extension of service between existing railway stations and a more convenient sub-terminal for the highway transportation. That was the problem that faced the Baltimore and Ohio in New York. It is complicated by the obvious necessity of the highway unit discharging its principal function of providing accommodations; that is to say, going where the people are who desire to use it, rather than attempting to force the people to inconvenience themselves because of remote location.

In solving the problem of co-ordinated terminals, the flexibility of the newer method of transportation and the accessibility of terminal service, must not be sacrificed, or the investment of the 52 steam roads in the great fleet of motor buses may prove disappointing.

Appendix C—Arrangement of Units and Operations for a Generalized Type of Large Hump Yard

In the 1927 Proceedings are the conclusions of the Yards and Terminals Committee that should govern the design of freight terminals. This year's report of the committee applied these principles to the design of a large hump classification yard. In order to clarify its remarks the committee submitted a plan of a generalized type hump classification yard. Some of the details in the study submitted by the committee are as follows:

In the study of the committee, no consideration has been given to the amount of property available or the topography of the country. The different units that go to make up a completed yard vary with different railways, with different kinds of traffic, etc., so that in this study only general principles of design are considered.

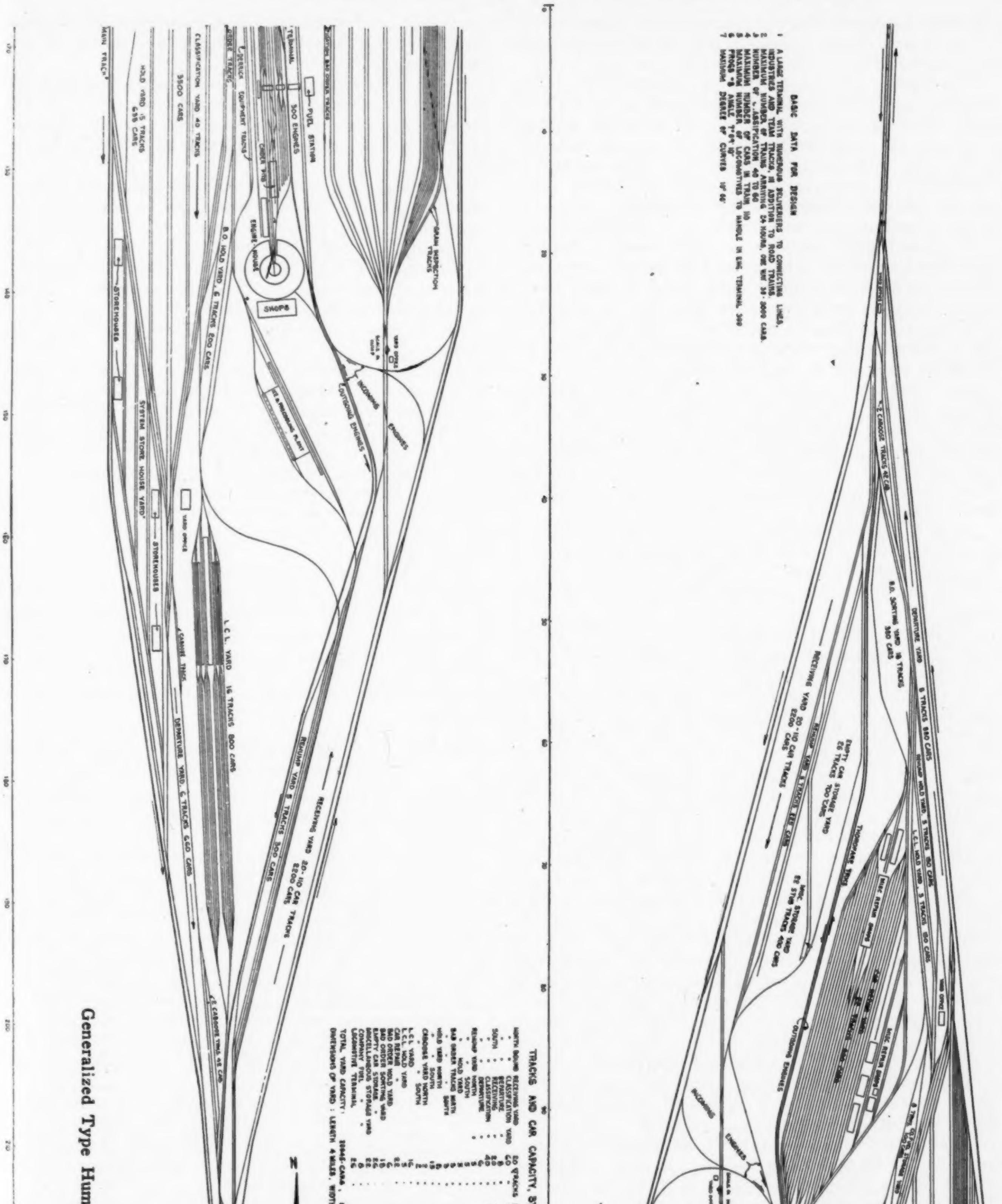
The northward main track passes by one side of the yard and the southward main track the opposite side. In practice, it is often desirable or necessary to have both main tracks on the same side of the yard, making it necessary to provide one or more thoroughfare tracks on the opposite side.

In this plan an auxiliary running track, located between the two main tracks, extends south from the south end of the yard, and such a track should be at least as long as the longest train that is run on this particular district.

The northward receiving yard consists of 20 tracks of 110 car capacity each, holding a total of 2,200 cars. There should be a sufficient number of tracks in the receiving yard so it will not be necessary to hold out trains on account of insufficient room.

In previous reports, the committee has set out a minimum number of tracks which should be sufficient to accommodate the number of trains arriving during a certain specified period. At one of the important yards of this kind, experience seems to indicate that the number of tracks should approximate 50 per cent of the number of trains entering the yard in a 24 hour period. The distance from the end of the receiving yard to the hump should be such as not to obtain an excessive gradient and to provide the necessary number of crossovers between the end of the yard and the hump, assuming there will be two tracks over the hump. There should be at least two crossovers in this territory in opposite directions.

There are provided in this classification yard three short tracks to receive bad-order cars. In some instances, it might be possible to set aside one of these tracks for light repairs and have this work done in this location, but to do this a second track must be



Generalized Type Hump Classification Yard

set aside for use while light repairs are being made, as repairmen cannot work on a track while cars are being humped to it.

There is provision made on one side of this classification yard for eight tracks for hold cars, such as grain held for inspection and coal held for billing. Provision is made for handling these cars back for rehumping without taking them back over the hump.

A series of crossovers is run through the easterly ten classification tracks, so that these tracks can also be used for hold cars in case the hold yard is full.

While in theory probably as many tracks should be provided in the departure yard as in the receiving yard, this may in practice be reduced if there is an opportunity to properly space the departing trains. Running trains directly out of the classification yard (thus doing away with pull-down engines) should result in economical yard operation.

The southward portion of the yard will, in general, consist of the same number and type of units as in the northward portion of the yard. The throat between the southward classification and southward departure yard is composed of three tracks, so that three movements between these yards to certain tracks can be made at one time.

As in the northward yard, provision is made for a departure yard. The number of tracks in this yard depends upon the number of trains it will be necessary to run from this yard and the schedule of these trains.

A caboose yard at the south end of the departure yard has a sufficient number of tracks to hold the cabooses required in the service.

In the southward unit provision is made for system storehouses and store yard tracks to serve. It is not always possible to incorporate a unit of this kind close to this type of yard, but where it is possible a considerable saving can be made as inbound cars can be moved direct from the classification yard to the store tracks and outbound cars handled over the hump with a minimum number of engine-hours.

The locomotive terminal is located between the two classification yards, resulting in a minimum amount of handling and of distance traveled by road and switch engines operating into and out of the yard. The plan provides for duplicate units of enginehouses, cinder pits and engine-storage tracks, all located for the greatest economy of space. If smoke will prevent safe and continuous operation of the humps then the locomotive terminal should be located at a more distant point. Such a location, however, will result in increased operating costs.

The location of the icing plant will depend, to a great extent, upon the direction in which the cars to be iced are moving.

In some yard locations it will be necessary also to provide tracks and other facilities to feed and water cattle, hogs and other livestock. The location of these facilities in the yard should be such as to have them accessible to the main line and permit trains to arrive and depart with the least amount of extra movement and delay.

With the development of car retarders it is probable that when the volume of business is such as to justify hump yards, this type of retardation will be used rather than car riders.

A system of floodlights is essential and should be so located and focused that the greatest amount of illumination is provided where most needed.

Water columns are located at the throat of the yards and at the ends, where locomotives can take water without interfering with the arriving or departing trains.

Unless modern facilities for handling waybills are provided in a yard of this magnitude, there is expense and delay in handling bills to the general yard office and getting them out as the train leaves the yard.

A recent installation includes the use of both pneumatic tubes and the teletype. With this arrangement there is no delay in getting the switching list prepared, so that as soon as the train has been inspected, it is ready for humping and only one man has been employed (the teletype operator) in the transmission of this information.

Air testing plants should be provided at each departure yard, and air lines run across the tracks so that as soon as trains are pulled down, the air equipment can be tested and the train line built up to the proper pressure before the arrival of the locomotive.

For weighing cars uncoupled as they pass over the hump, a scale should be provided just below the apex of the hump, the gradients being laid in such a manner that immediately after uncoupling, the car will accelerate to such an extent that it will clear the car following and not pass over the scale too fast to be weighed.

Some provisions should be made for varying the height of the hump during the summer and winter, as a gradient that gives the proper speed for loads in summer is not adequate for loads in the winter. This is accomplished in yards with two hump tracks, by raising one of the tracks two or three feet above the elevation of the track on which loaded cars are humped.

Appendix D—The Proper Width of Driveways for Team Tracks and for Freight Houses

Following an extended and thorough treatment of this subject, the committee offered the following conclusions:

1. Team-track driveways normally should be of a sufficient width to allow the longest trucks using the driveway to stand at right angles to the car, with sufficient space remaining in front of the truck to allow another truck of maximum width to pass.
2. Team-track driveways of sufficient width to enable two maximum-size trucks to load opposite each other at right angles to the cars, and with a clear passageway between them for the passing of a maximum-width truck, are not justified economically except in special cases where an extremely intensive truck traffic is handled.
3. There probably will not be any further tendency to increase the maximum size of trucks now being operated in team-track and freight-house service. The maximum overall size of truck recommended for determining team-track and freight-house driveway widths is 8 ft. by 27 ft.
4. Outside of heavy machinery, heavy rolls of paper, and similar shipments, practically all commodities handled on team tracks are adapted to side loading of trucks.
5. At present only about ten per cent of the trucks used in team-track service are adapted to side loading.
6. It is not advisable at the present time to recommend generally a width of team track based on exclusive side loading trucks, though the economic advantages of this method of loading from the railroad's standpoint are obvious. Truck manufacturers should be encouraged in the building of trucks adapted to side loading.
7. The following clear widths of team-track driveways are recommended for the various conditions indicated:

(A) Where side loading of trucks is employed exclusively:
For driveway alongside one track......20 ft.
For driveway between two tracks.......30 ft.
(B) Where side loading of trucks is not universally followed:
Normal conditions,

For driveway alongside one track......37 ft.
For driveway between two tracks......40 ft.
For backing-up space alongside a public thoroughfare ....27 ft.
Where land value is high,
For driveway between two tracks.......35 ft.

8. The distance between track centers where the driveway is located between tracks, should be ten feet greater than the width of the driveway.

9. The spacing of tracks, where multiple team tracks are built, may be fixed by regulatory bodies, but it is recommended that the minimum distance between track centers be 13 ft.

10. Stub-ended driveways serving team tracks should be avoided. Where team tracks are more than 20 cars long (per single track), intermediate connecting cross drives should be provided. In large team-track developments where exceptionally long tracks are provided, cross drives should be introduced so that 14 cars per track is the maximum length between any two drives.

11. The maximum width of a freight-house driveway should be sufficient to provide for trucks backed up to the freight house at right angles and to leave room in front of the truck for two trucks to pass.

12. Freight-house driveways should be of the following minimum widths for the various conditions indicated:
(A) With tailboard on one side..........47 ft.
(B) With tailboard on both sides..........70 ft.
(C) Free back-up space alongside a public street ....27 ft.

Appendix E—Scales

The committee confined its work to the subject: Study and report upon the disposition of track scales which have been removed by reason of inadequacy, obsolescence or inaccuracy.

The following are stated as the possible methods of disposing of a track scale which has been removed for the causes stated: 1. Sell as scrap metal after being rendered unfit for further use as a scale or parts thereof. 2. Retain for use as repair parts of existing scales of the same type and size. 3. Retain for working over the parts into motor truck and other similar scales. 4. Re-install in a new location. 5. Sell as scrap metal in the same condition as when removed from service. 6. Sell as a scale in the same condition as when removed from service. 7. Repair and sell as a complete scale.

In considering these various methods of disposition, it is immediately evident that method No. 1 requires no comment in this discussion, except to the effect that it is entirely proper and justifiable. The same comment applies also to method No. 2, except that, obviously, the necessity for so utilizing the old parts will gradually diminish with the decrease in the number of obsolete track scales retained in service. As to method No. 3, examination of the motor truck scale specifications adopted by this Association in 1923, will at once indicate the practical undesirability of this method.

In discussing method No. 4 it was stated that the railways in general have expressed their views as to what sort of track scales they desire to install when a new scale is necessary. This choice is represented by the 1920 track scale specifications of the American Railway Engineering Association, which specifications have become, through general acceptance, the standard track scale specifications of the country. There is no record of any serious criticism during the past seven years of any section of the present standard specifications. Then, since both the railways and the general public have so universally accepted the present track scale specifications, the question is pertinent as to how a railway can consistently justify the installation by itself of a scale which does not embrace the details which have been accepted as being correct.

The discussion of methods 5, 6 and 7, evolved around the theory that if it is false economy for a railway to install a so-called "cheap" scale, then it is also false economy for an industry to do likewise. It therefore appears that the railways should encourage the installation by industries of "standard" scales, and, as a means to that end, should so dispose of their worn-out and replaced scales that such scales will not fall, either directly or indirectly, into the hands of industries, the managements of which, misled by the low first cost, may easily believe that the installation of such scales will result in ultimate economy.

From this standpoint, the committee stated that methods 5, 6 and 7 are entirely devoid of merit, and that a definite recommendation to his effect should be adopted.

Conclusions

A track scale which has been removed by reason of inadequacy, obsolescence or inaccuracy, should be disposed of in either of the following ways:

1. Treat as scrap metal after rendering unfit for further use as a scale or parts thereof.
2. Retain for use as repair parts of existing scales of the same type and size.

Discussion

[Chairman J. E. Armstrong (C. P.) presented the report and *his motion that the wording in the Manual as to gradients for passenger ramp be amended was carried.* He also *moved that in all parts of the Manual where reference is now made to three-second minimum weighing time, the value be changed to four seconds.*]

G. D. Brooke (C. & O.): Does that apply to plate fulcrum scales as well as other scales?

Chairman Armstrong: Yes.

Mr. Brooke: What speed would that give for a big plate fulcrum scale?

H. M. Roeser (U. S. Bureau of Standards): The speed could be calculated from the length of scale. You know the length of the rail, you know how fast the car would travel to get across the scale in two seconds. It would depend on the length of the car, too.

Mr. Brooke: If this recommendation is adhered to, you cannot improve the capacity of your hump by improving your scale, can you?

Mr. Roeser: I do not believe the weighing time cuts down the operation of your hump, it is too small a portion of the time. If you were humping cars to conform to their weighing time, you would be shooting cars over the hump, 15 cars a minute.

[The motion was carried, following which H. L. Ripley (N. Y. N. H. & H.), chairman of the subcommittee, presented the report on passenger terminals, and L. L. Lyford (I. C.), subcommittee chairman, presented the report on freight terminals, both of which were received as information. C. H. Mottier, subcommittee chairman, then presented the report on driveways and moved that it *be accepted as recommended practice and approved for publication in the Manual.*]

L. Brousseau (C. N.): It seems to me that the recommendation in Conclusion 10 is somewhat premature and deserves further study before being incorporated as a conclusion. It is noted that the committee found difficulty in locating team tracks with sufficient density of traffic, resulting in a large amount of delay. In another part of the report it is stated that the number

of observations made was somewhat inadequate to make precise assumptions. When looking at the questionnaire on driveways, the subject of cross drives is not even mentioned. Cross drives and their locations involve operating principles which are important, such as delays in switching cars and the considerable amount of coupling and uncoupling, as well as the spotting of cars to give room for these cross driveways. Will these conditions not outweigh the slight reduction in delays to traffic on the driveways concerned?

Chairman Mottier: It is a question of judgment. We have studied it very carefully. We have talked to men who operate team tracks, both from the railroad side and also the operators of trucking concerns. Our recommendation figures out on the basis of 42 ft. per car; that is the old recommendation; the new recommendation is 45 ft. per car; it is 588 ft. In other words, it is about one-ninth of a mile. We found in our studies that many old team tracks with narrow driveways that were practically obsolete have been made serviceable by cutting them up into shorter lengths. It is the opinion of this committee that the recommendation should stand.

[*A motion to that effect was put and carried.* The report on scales was presented by Mr. Roeser.]

Mr. Roeser: Carriers have sold various and numerous types of scales to scrap dealers for reasons of inadequacy or obsolescence. Later they have found themselves accepting weights of carload freight over these same scales through a weight agreement which their traffic departments have made with the different shippers. This consideration and other minor ones have led to the conclusion of the committee relative to the disposal of scales.

C. W. Baldridge (A. T. & S. F.): The committee makes a mistake in including the word "inadequacy" in the first conclusion. It is possible for a thoroughly good, accurate scale to become inadequate as to size for general use in a railroad yard, and at the same time that scale might be abundantly large for the use of some industry. I favor the adoption of the conclusion with the word "inadequacy" stricken out.

Mr. Roeser: It would not be wise to strike that word out for the reason that scales which become inadequate for railroad use, as a result of being too light in design and construction are actually too light for use in practical weighing of freight anyway. Any scale anywhere is likely to have to weigh the maximum loaded car. Sometime a consignee is going to weigh coal and other material coming into his plant for accounting purposes and for the purpose of filing claims against the carrier for short weighing. For that reason it is extremely important that every shipper who handles his freight on a weight agreement basis with the railroad should have exactly the same kind of a scale that the carrier would have if it were doing the weighing itself.

[*A motion to adopt the conclusion of the committee was made and passed.* Following a report of progress on the assignment of hump yard design, by Chairman Armstrong, the committee was excused with the thanks of the Association.]

Report on Economics of Railway Location

F. R. Layng (B.&L.E.)
Chairman
F. L. Batchelder (C.R.)
J. L. Campbell (S.P.)
W. C. Coles (B.&O.)
Walter Constance (C.&O.)
C. E. Day (S.P.)
F. B. Doolittle (N.Y.C.)
A. W. Galbreath (M-K-T)
W. L. R. Haines (Penna.)
C. P. Howard (I.C.C.)
E. E. King (U.of Ill.)
Frank Lee (C.P.R.)
Fred Lavis (Cons.Engr.)
R. S. Marshall (C.&O.)

F. R. Layng

H. C. Searls (M.P.)
Vice-Chairman
J. A. Noble (A.T.&S.F.)
F. M. Patterson (Ry.Age)
C. L. Persons (C.B.&Q.)
J. L. Pickels (D.W.&P.)
I. L. Pyle (C.&O.)
A. K. Shurtleff (A.R.E.A.)
L. O. Sloggett (I.C.)
P. E. Thian (N.P.)
Walter L. Webb (Cons.Engr.)
W.H. Winterrowd (Lima L.Wk.)
J. C. Wrenshall (Reading)
F. E. Wynne (Westingh. El.Co.)
M. A. Zook (M.W.&S.)

THE REPORT of the committee comprised:

(1) A study of the conomics of railway location as affected by the introduction of electric locomotives (Appendix A).

(2) A study of the relative merits of increasing tonnage by the reduction of ruling grades, or by the introduction of more powerful locomotives, including the consideration of momentum grades and the availability of the locomotive booster (Appendix B); and

(3) A study of locomotive capacity, giving special attention to oil-burning locomotives (Appendix C).

The reports in Appendices A and B were presented as progress reports and it was recommended that they be received as information. It was also recommended that the data in Appendix C be received as information.

Appendix A—Economics of Railway Location as Affected by the Introduction of Electric Locomotives

When the traffic on a portion of a railway fully equipped with the most modern steam locomotives and the using of other most modern facilities is approaching the limit of track capacity, one of the questions which naturally arises is "Shall the grade

be revised or shall the existing line be electrified?" The answer cannot be given offhand but the problem is subject to an economic solution. This solution involves certain steps. The grade revision must be designed and its cost calculated. The performance of steam locomotives on the revised grade must be determined and the best combination of train weight, speed and distribution of trains selected for the expected amount of traffic. The total cost of steam operation on the revised grade, including operating expenses, depreciation, taxes and interest on the new investment, may then be estimated.

On the other hand, the cost of electrification of the existing line must be calculated, the performance of electric locomotives determined and the best method selected for handling electrically the expected amount of traffic. The total cost as defined above of electric operation of the existing line may then be estimated and compared with that for steam operation of the revised line and a conclusion drawn on an economic basis.

The Manual gives a method for determining steam locomotive characteristics, and performance in service. The designers of electric locomotives are in a position to supply characteristic curves for any type and size of electric locomotive. From these characteristic curves, the detailed locomotive performance in service can be predicted with a high degree of accuracy. The committee feels that a method of determining the service performance of the electric locomotive from its characteristic curves will be useful information for the Association to have in its records, and stated that the preparation of this information, together with typical examples of its application, is in progress.

Appendix B—Increasing Tonnage by Reduction of Grades, or Introduction of More Powerful Locomotives

The main elements to be considered in this problem are those of the general problem, viz.: Revenue, expense and investment. There may be presented the present alternative of doing several different things: (1) Get more powerful engines; (2) Reduce grades; (3) Increase the number of main line tracks; or (4) Improve the signal system and yard facilities.

It is evident that any one, or a combination of these four alternatives, may be advisable in a given case. The first two, it is evident, are not necessarily alternatives. In certain cases both may be resorted to simultaneously to advantage. Thus it may pay to reduce the grades, assuming no increase in the power of locomotives. But a further computation may show that with the grades so reduced an additional saving may be effected by the use of heavier locomotives.

The most general form of the problem is probably —which expenditure, if either, should be made first.

Advantages in the Use of Heavier Locomotives to Handle an Existing Traffic

These are:

(1) Their purchase is easily financed.

(2) Their total cost may be assumed as approximately the same as the cost of a greater number of smaller locomotives to do the same work. Similarly for repairs and renewals. There is no necessary increase in the permanent investment in equipment or in repairs and renewals of same.

(3) In many cases it happens that the cost of heavier locomotives can be more accurately determined in advance than the cost of contemplated grade reductions.

(4) Usually it takes less time to purchase locomotives than to make grade revisions, and there is quicker return on investment.

Disadvantages of Heavier Locomotives to Handle an Existing Traffic

These are:

(1) Longer turntables, larger engine stalls.

(2) Heavier rails may be necessary.

(3) More ballast may be required, this in turn requiring the widening of the roadbed.

(4) The strengthening of bridges and trestles may be required.

(5) The lengthening of passing and certain yard tracks. This disadvantage also applies to lengthening trains by reducing grades.

Advantages of Grade Reduction vs. Heavier Locomotives to Handle a Given Traffic

As compared with an increase in the size of locomotives to effect the same reduction in the number of train miles, grade reduction has the following advantages:

(1) No increase in investment in equipment.

(2) Reduction in operating expenses due to saving in engine repairs, and renewals, and in fuel and water, provided the rise and fall is also reduced as it usually is.

(3) A future possible saving, assuming that additional main tracks will be needed in the not distant future, and that it will later be necessary to reduce grades.

For, if second, third and fourth tracks are added on the present grades, and later it becomes necessary to reduce grades (probably involving also changes in line) the amount of work thrown away, and to be charged off the investment, will be much greater than if the grade had been reduced in the first place.

A moderate grade reduction will not save as much on certain classes of trains. They may be entirely unaffected by it. These are passenger trains, local and package freights, and certain fast freights in some cases.

Estimated cost of grade reduction should include the lengthening of passing tracks, and new bridges, when necessary, should be constructed so that they may be ultimately used for heavier power, at a minimum of additional expense. If additional tracks will probably be needed, there is an advantage in grade reduction. The question of the permanency of the proposed route must be considered before going to heavy expenditures on a given line.

Best General Rule

Make a careful survey of present conditions, a forecast of future conditions and careful computations of the savings to be effected on each alternate plan to fit the present or future assumed conditions, and compare results. As there must necessarily be many important conditions that cannot be accurately forecasted, a good deal of judgment must be used. It is recommended, however, that the computations be made first and judgment exercised afterwards. The whole computation, if the conditions can be correctly forecasted, is a matter of computing the greatest net earnings on the money to be permanently invested.

It is pointed out that if the decision is made that

a grade revision is the answer to the problem the work should be done as promptly as possible for the reason that this country is expanding rapidly, construction costs are rising, and for the further reason that municipal and private improvements will make a proposed change more expensive if delayed. It should also be borne in mind that in some cases permanent improvements such as grade separation projects will be demanded on the existing line, which improvements may become entirely useless when the new grade line is constructed.

Appendix C—Locomotive Capacity, Giving Special Attention to Oil Burning Locomotives

The data in this appendix pertain entirely to the locomotive booster, and were prepared by W. H. Winterrowd. It is given in abstract in the following.

From a perusal of the various items that go to make up the total operating expense of the railways, it will be observed that the majority are affected directly by power. Thus power must receive primary consideration in any analysis in which the object is a reduction in the expense.

The locomotive booster is a simple, double-acting steam engine, having 10-in. by 12-in. cylinders. The power from these cylinders is transmitted through crankshaft and gears to the trailer wheels of the locomotive, or to the wheels of the front truck of the tender. The gear ratio between the booster and the trailer axle is 2.57. The control used in conjunction with the booster is of the semi-automatic type. In order that the booster may be put in use it is merely necessary that the main throttle of the locomotive be open and the booster latch on the reverse lever be lifted, so as to open the reverse lever pilot valve. The control valves then permit steam to enter the cylinders to idle the booster, so the booster gears idle and intermesh, open the main booster throttle and finally close the cylinder cocks, thus permitting the booster to deliver its maximum power.

At the present time four types of boosters are being manufactured and are in use. These types are the "C-2-L," "C-2-S," "D-1-L" and "D-1-S." Both of the "C-2" types are for locomotives of standard gage. The "C-2-L" booster has an average cutoff of 75 per cent stroke, while the "C-2-S" booster has a cutoff of 50 per cent stroke. These two types of boosters are applicable to either the trailer or tender of the locomotive.

Inasmuch as all track in this country is of standard gage, only the type "C-2" booster will be considered. From many tests on various railways and on our test plant it has been possible to obtain the drawbar pull, horsepower, mechanical efficiency and water rates for the booster. It has been determined from the various tests that the "C-2-L" booster will deliver the drawbar pulls derived from the following formula, in which the numercial factor takes into consideration the mean effective pressure, drop in pressure in booster inlet line and the mechanical efficiency of the booster.

$$D.B.P. = \frac{2475 \times P}{D},$$

when P = Boiler gage pressure
D = Diameter of trailer wheel.

The drawbar pull for the "C-2-S" booster can be derived from the following formula,

$$D.B.P. = \frac{2250 \times P}{D},$$

the numerical factor taking into consideration the same items mentioned for the "C-2-L."

The power which is developed by the booster as supplemental power for the main engine, makes it possible to start and haul greater train loads on any grade. The booster is one means of obtaining greater power per locomotive unit, thereby making it possible to increase train loads and thus decrease unit costs. The other means of obtaining greater power is through the medium of additional drivers, which of necessity causes an increase in locomotive weights. Because the booster makes it possible to handle an increased train load it will sometimes be found that a locomotive with a less number of drivers and the booster may be used in place of the more powerful locomotive. This reduction in the number of drivers will show substantial economies in locomotive maintenance, while the use of the booster will increase locomotive maintenance by only $0.005 per locomotive mile, a very small proportion of the locomotive maintenance expense for any type of engine.

On one road it was found after several years that the business delivered by the connecting lines could not be handled in one train unit with one Pacific type locomotive, as was previously the case. It was, therefore, necessary to either double-head or use heavier engines to handle the business in one train unit. The road naturally chose the last mentioned method and substituted a Consolidation type locomotive for the Pacific type which was in use. After several years of operation with the 2-8-0 type locomotive a study of the operation was made, which revealed that the cost of locomotive maintenance with the Consolidation type was $0.30 per locomotive mile, while with the Pacific type it was $0.19.

A study of the local conditions relative to the use of a booster on the Pacific type showed that train loads were based entirely on starting on the maximum grade. The supplemental power of the booster as applied to the Pacific type locomotive gave the same starting power as the Consolidation type locomotive. At a speed of 8 m.p.h. there was a slight deficiency in power with the booster-equipped Pacific type locomotive. At a speed of 25 m.p.h. the Pacific type locomotive developed greater power than the Consolidation. The booster was therefore applied to the Pacific type locomotive. The service rendered was the same with both the Consolidation and booster-equipped Pacific, but in using the Pacific type equipped with the booster the maintenance cost of the locomotives for this service was reduced from $0.30 to $0.195 per locomotive mile, a saving of $0.105 per locomotive mile attributable to the booster.

In another instance the traffic on one sub-division of a railway had increased to such an extent that the trains being brought from the first division into the terminal could not be carried over the second division in one unit, and therefore a greater number of train units were necessary for this division than for the first division. It was realized that a locomotive with greater power would handle greater tonnage per train unit and thus reduce the number of necessary train and locomotive miles. A study was made to determine whether or not to use a 2-10-2 type locomotive or equip the existing Mikado locomotive with the booster. It was found from this study that whereas the existing operation was costing $0.734 per 1,000 gross ton miles, the estimated cost of operation with a 2-10-2 type locomotive handling 500 additional tons per train unit would be $0.642 per

1,000 g.t.m. and with the present Mikado and booster, capable of handling 400 additional tons per train unit, the cost would be $0.611 per 1,000 g.t.m. This road therefore decided to apply boosters to the existing power. After the boosters were in operation for a sufficient period of time a check of the operation showed that while the operation without boosters cost $0.734 per 1,000 g.t.m. the operation with boosters during a similar period had cost $0.605 per 1,000 g.t.m. Thus the increased train load made possible by the booster actually caused a reduction of $0.129 per 1,000 g.t.m., which is equivalent to a reduction of 17.6 per cent.

Discussion

[The report was presented by the committee chairman F. R. Layng (B. & L. E.) and the various sections were outlined briefly by the respective subcommittee chairmen. Included among the sectional reports was one by W. H. Winterrowd (Lima Locomotive Works) who commented on the report on locomotive boosters in part as follows:]

Mr. Winterrowd: The locomotive booster is a supplementary locomotive which adds tractive effort. The application of this device to existing power as well as to future power is a matter of strict economics, and in an endeavor to place before you sufficient information from which you could calculate under your own conditions the advantages and the economics of a piece of equipment of that kind, this presentation was prepared. It is a resume of a kind that has not before been put before any of the engineering societies to the best of my knowledge.

[This report was received without discussion and the committee excused with thanks.]

Report of the Committee on Electricity

Edwin B. Katte (N.Y.C.)
Chairman
F. Auryansen (L.I.)
B. F. Bardo (N.Y.,N.H.& H.)
H. M. Bassett (N.Y.C.)
R. Beeuwkes (C.M.St.P.& P.)
D. J. Brumley (I.C.)
J. C. Davidson (Am.Loc.Co.)
J. H. Davis (B.& O.)
J. V. B. Duer (Penna.)
F. D. Hall (B.& M.)
W. L. Morse (N.Y.C.)
R. J. Needham (C.N.R.)

Edwin B. Katte

S. Withington (N.Y.,N.H.& H.)
Vice-Chairman
A. E. Owen (C.R.R.of N.J.)
J. A. Peabody (C.& N.W.)
M. Schreiber (Pub.Ser.Ry.)
W. M. Vandersluis (I.C.)
H. M. Warren (D.L.& W.)
L. S. Wells (L.I.)
C. G. Winslow (M.C.)
R. P. Winton (N.& W.)
G. I. Wright (I.C.)
A. H. Woollen (Aluminum Co.)

FIFTEEN subjects were reported on by the Committee on Electricity. Progress reports were submitted on inductive co-ordination (Appendix B); electrolysis (Appendix D); overhead transmission lines and catenary construction (Appendix F); collaboration with the Committee on Economics of Railway Location (Appendix G); protection of oil sidings from danger due to stray currents (Appendix K); specifications for track and third-rail bonds (Appendix L); design of indoor and outdoor substations (Appendix N); and high voltage cables (Appendix O). The reports submitted as information included those on water power (Appendix C); co-operation with the U. S. Bureau of Standards in revision of National Electrical Code (Appendix E); standardization of friction and rubber tape specifications (Appendix H); insulator specifications (Appendix I); working conductors (Appendix J); and revision of schedule of incandescent lights. It recommended that no change be made in the Manual other than the removal of the present tungsten lamp schedule (Appendix M).

Appendix C—Water Power

The committee investigated and submitted for information, brief reports on the following water power developments: (1) the international development of power on the St. Lawrence river; (2) the tidal water power project on Passamaquoddy bay, off the Bay of Fundy; (3) water power development on the Saguenay river near Lake St. John, in the Province of Quebec; and (4) water power development on the Gatineau river near Ottawa, Ont., Canada. It also submitted a brief report on power projects on the Tennessee river.

Appendix D—Electrolysis

The committee reported having assisted in revising a chapter on stray current electrolysis prepared by a member for the book on "Corrosive Engineering," compiled by Dr. F. N. Speller. Considerable attention to the various aspects of the "Grounding Rules" was also reported. The committee also advised that it had criticized a paper on "Electrolysis Mitigation," by E. R. Shepard, as submitted by the Bureau of Standards.

Appendix E—Co-operation with U. S. Bureau of Standards

The committee has conferred with the U. S. Bureau of Standards in the revision of the National Electrical Safety Code, under the procedure of the American Engineering Standards Committee. On November 15, 1927, the American Engineering Standards Com-

mittee approved the entire revised code as American Standard, designating it as Number C2-1927. Various parts of the code as heretofore printed by the Bureau of Standards and now available as separate publications (Handbooks 6 to 9, inclusive) are now being printed together under one cover as a new edition of Handbook No. 3 of the Bureau of Standards.

It was concluded that the work be continued in co-operation with the U. S. Bureau of Standards for the revision of the National Electrical Safety Code under the procedure of the American Engineering Standards Committee for any part of the code that may be re-opened or in the preparation of specifications for supply lines crossing railroads and with representatives of the National Electric Light Association in the preparation of a general agreement as to principles and practices, with accompanying specifications, covering power wire crossings over railroads to be made the standard of both associaitons.

Appendix F—Overhead Transmission Line and Catenary Construction

The committee had under consideration the two following subjects during the year: revise and keep up to date the transmission line specifications previously adopted; and the study and design and construction for catenary supported working structures. On the first subject, the committee reported that it recommended no changes or additions at the present time.

In handling the second subject, the sub-committee of the committee developed a preliminary draft of specifications covering design and construction for catenary supported working conductors. This draft was reviewed by the full committee, following which certain changes and additions were incorporated. The revised specifications in tentative form were submitted, these covering 14 pages in the bulletin. The requirements of these specifications with respect to loading, unit stresses, etc., conform in general with those of the transmission line specifications. It was pointed out that the specifications are subject to further revision.

Appendix H—Standardization of Friction and Rubber Tapes

From correspondence with representatives of the Telegraph and Telephone Section, the Signal Section, and the Mechanical Division, the committee found that the concensus of opinion was that no changes should be made in the specifications. The suggested changes were discussed at the meeting of the Electrical Section on April 27, 1927, and at that meeting it was decided not to approve the proposed revisions.

Appendix I—Standardization of Insulators

The committee reported that the following action has been taken: (1) The committee is of the opinion that a revision of the insulator specifications is not called for at this time, and that it recommends approval of the report of the Department of Commerce on One-Piece Porcelain Insulators which it presented with its report. (2) The committee has secured a limited amount of information covering the tensile strength of suspension type insulators, and has noted the increase in strength of the newer designs. It is of the opinion that there is not information of sufficient importance before it to justify a report this year.

Appendix J—Clearances for Third Rail and Overhead Working Conductors

In its report which was submitted for information, the committee presented tables indicating up-to-date practice on 117 electrified roads, for third rail and overhead clearances. The data included replies to the following questions: top or under contract; protection or not; steam equipment or not; structures clear property lines; mileage in operation; mileage planned for immediate future; mileage using steam equipment; horizontal distance between center of third rail and gage line of nearest running rail; and vertical distance between contact plane by third rail with top of running rail.

Appendix L—Specifications for Track and Third Rail Bonds

In the report of the committee, tentative specifications for the measurement of bond resistance were presented in detail, together with tables, line drawings and charts. The committee also reported that work had been continued on the following subjects which formed a part of its assignment: securing data on current carrying capacity of bonds; study of details of bond design with a view to developing specifications covering the different classes of bonds; the effect of heat of welded bonds on track rails, co-operating with the Rail committee; and means of attaching bonds to manganese track rails.

Appendix M—Illumination

The committee's report dealt with the incandescent lamp schedule, and floodlighting. In connection with the first subject, the committee reviewed and revised the tungsten lamp schedule as it appeared in Bulletin 291 of November, 1926, and submitted it as a part of its report. The changes made consist primarily of increasing the voltage of cab lamps from 33 to 34, and permitting the use of 34-volt lamps for headlight service. A 60-watt, 32 or 34 volt, P-25 bulb for headlight service was added to the list. The G.18½ bulb, in the 23 and 36-watt lamps in headlight service, street railway lighting service, has been changed to the new manufacturers' standard, A.19. These changes have been made to correspond with the incandescent lamp schedule recommended by the Mechanical Division of the American Railway Association.

In its consideration of the second subject, floodlighting, the committee found that certain data are not yet available, and, therefore, the committee found it necessary to revise its schedule of work. A careful review of existing data, however, seemed to indicate that certain factors have been rather definitely determined and established through continued use. As reported upon by the committee, these factors dealt with the following subjects: illumination intensities in freight yards; illumination values at engine terminals; height of lighting units; glare reduction; location of lighting units; and tower design.

In conclusion, the committee recommended that the incandescent lamp schedule be accepted as recommended practice, but not included in the Manual.

Appendix N—Design of Indoor and Outdoor Substations

The work under this assignment included five subjects. Under the first subject, relative to conditions affecting the selection of indoor and outdoor types of station, the committee expressed the feeling that there are two major conditions to be given consideration: first, the location of the substation with respect to sur-

rounding property, as well as the character of the property; and second, the character of apparatus which the substation is to accommodate.

Under the second subject assigned to the committee, the applicability of various methods of controlling substations, the report dealt in detail on manual, remote, supervisory, semi-automatic and automatic control.

The remainder of the report dealt in detail with the various units of equipment in substations, and with several important miscellaneous subjects such as grounding and unit-type substations.

Discussion

[In the absence, owing to illness, of the chairman, E. B. Katte (N. Y. C.), the report was presented by Sidney Withington, chairman of the Electrical section, A.R.A., who had the various subcommittee chairmen outline the work done by their committees. The reports on electrical interferences, water power, electrolysis and electrical safety codes were received without discussion, following which Subcommittee Chairman B. F. Bardo (N. Y., N. H. & H.) outlined the report on the design and construction of catenary conductors.]

M. Hirschthal (D. L. & W.): I have written the secretary covering some suggestions, but one point wasn't covered in my letter. It is in connection with the report, Loading on Supports, and particularly the words, "On flat surfaces these unit wind pressures shall be increased by 60 per cent." This is an inconsistency in the results obtained by applying this 60 per cent correction. In so far as heavy loading is concerned, there is a wind pressure of 8 lb. per sq. in. which is correct for the wires of greater exposure, but for the supports, there is no correction. On the medium catenary loading we have allowed 10 lb. and on the light loading 15 lb. with the result that applying the 60 per cent correction, gives a greater loading for the light catenary, slightly less loading for the medium, and the smallest loading for the lightest catenary loading. I think the committee should make a correction in the report to cover that inconsistency.

[The correction was referred to the committee and that section of the report accepted without further discussion. This was followed by the presentation of the reports on insulating tape, insulators, stray currents, track and rail bonds, illumination, substations, high tension cables, and recommendations for the Manual, all of which were accepted without other discussion than brief introductory remarks by members of the committee including C. L. Bardo (American Brown-Boveri), K. H. Gordon (Penna.) and W. M. Vandersluis (I. C.) and the committee was excused with the following remarks from President Brumley.]

President Brumley: I wish to call your attention to the vast amount of work that the committee has laid out for itself next year. There are a great many things to be worked out in connection with the electrification of railways. We have a group of men so much interested in this matter that they are willing to take their own time and effort to prepare some written reports of great value to the association.

Report on Economics of Railway Operation

James M. Farrin (I.C.)
Chairman
R. B. Abbott (Reading)
B. T. Anderson (C.& O.)
G. E. Boyd (Ry.Age.)
J. N. Brand (A.C.L.)
G. D. Brooke (C.& O.)
J. M. Brown (C.R.I.& P.)
M. L. Byers (S.A.L.)
S. B. Cooper (Westinghouse Elec.)
H. C. Crowell (Penna.)
W. J. Cunningham (Harvard U.)
A. M. Currier (N.Y.C.)
L. E. Dale (Penna.)
D. M. Driscoll (N.P.)
G. F. Hand (N.Y.,N.H.& H.)
Albert Hansen (B.& O.)
E. E. Kimball (Gen. Elec.)
L. E. Little (N.Y.,N.H.& H.)
T. C. Macnabb (C.P.R.)
M. F. Mannion (B.& L.E.)


James M. Farrin

F. H. McGuigan (Prudential)
Vice-Chairman
H. A. Osgood (Fulton Iron)
H. T. Porter (B.& L.E.)
L. H. Powell (A.T.& S.F.)
J. F. Pringle (C.N.R.)
L. S. Rose (P.& E.)
Mott Sawyer (C.M.St.P.& P.)
R. T. Scholes (C.B.& Q.)
B. J. Schwendt (N.Y.C)
A. C. Shields (D.& R.G.W.)
V. I. Smart (C.N.R.)
M. F. Steinberger (B.& O.)
J. E. Teal (C.& O.)
F. L. Thompson (I.C.)
Barton Wheelwright (C.N.R.)
J. L. White (A.C.L.)
C. C. Williams (U.of Iowa)

THE COMMITTEE submitted progress reports on:

(1) Methods for obtaining a more intensive use of existing railway facilities, with particular reference to increasing carrying capacity; (a) without material additional capital expenditures; (b) with due regard to reasonable capital expenditures consistent with traffic requirements (Appendix A).

(2) Methods or formulas for the solution of special problems relating to more economical and efficient railway operation (Appendix B); and

(3) Suitable units for operating and equipment statistics required by Interstate Commerce Commission, to be used in cost comparison of transportation, equipment and roadway maintenance, with necessary additions thereto (Appendix D).

It submitted as information reports on:

(1) Studies to determine the most economical makeup of track to carry various traffic densities (Appendix C).

(2) The volume or other conditions of business or service which justifies a change from flat switching to the hump method in any given yard (Appendix E); and

(3) Problems of railway operation as affected by the introduction of motor trucks and bus lines, with

particular reference to its effect upon branch or feeder lines (Appendix F).

No changes were recommended in the Manual.

Appendix A—Methods for Obtaining More Intensive Use of Existing Railway Facilities

The primary object of this committee's work has been to study the effects of various changes in operating conditions upon freight train performance to determine the extent to which these changes increase the traffic capacity of a railroad.

Thus far it has investigated the following: (1) The effect of the number of trains per day; (2) The effect of the length of engine district; (3) the effect of double-tracking; (4) The effect of passenger train operation upon freight train performance; (5) The effect of supervision; (6) The effect of substituting heavy steam power for light; and (7) The effect of installing automatic signals.

This year the committee felt that a report containing the operating statistics and physical characteristics of a heavy traffic single-track road or section of road showing what traffic can be handled on a single-track road would be very valuable. Also what improvements if any were made to increase this capacity and the effects. In making its report, the committee selected the heaviest traffic section of a single-track railroad, upon which average steam railroad conditions exist, that it could find. The selection was a 48-mile single-track section of one of the large southern roads, on which an average of 28 passenger trains and 28 freight trains were operated per day (both directions) during 1926. After a thorough study of this section of track, which was presented in the report, the committee offered the following conclusions:

(1) Increased supervision, consisting of scientific study and thoughtful effort, will increase the capacity of a railway.

(2) Installation of automatic block signals on a single-track railway will increase the capacity of the road, this increase varying with the length of the division and the number of passenger trains operated.

(3) The above methods of increasing capacity are economical, resulting in a saving in road time on present traffic and increased earnings as traffic increases.

(4) In addition to the increase in capacity, supervision and automatic signals provide other intangible benefits.

(5) A single-track railway, with proper supervision eliminating unnecessary delays and train stops, the proper number and spacing of sidings, and proper signaling is a very efficient transportation machine, all of which have more intensive use than a double track line handling traffic which does not reach its capacity.

Before a second track is constructed careful study should be given to the practicability of increasing the capacity of the single track, either by increased supervision and study of operation, signals, or electrification, etc.

Appendix B—Methods or Formulas for Solution of Special Problems Relating to More Economical and Efficient Railway Operation

No new work was undertaken this year, all the efforts of the Committee being devoted to editing last year's report on the cost of stopping trains for printing in the Manual.

Appendix C—Determine the Most Economical Makeup of Track to Carry Various Traffic Densities

No sub-committee was appointed to take up this work as it developed that a similar assignment was being studied by the Committee on Rail. It is therefore recommended that this subject be held in abeyance until the Rail committee has made its report and reliable data are available for conclusions.

Appendix D—Units for Operating and Equipment Statistics Required for Comparisons of Transportation, Equipment and Roadway Maintenance

No definite conclusions were reached this year by the committee, that could be added to last year's report, and it was recommended that the subject be reassigned for further study.

Appendix E—What Volume of Business Justifies a Change from Flat to Hump Switching

This year's work of the committee consisted in analyzing answers to a questionnaire sent out last year. Fourteen railroads replied to the questionnaire, their answers being summarized in part as follows:

1. How many hump yards have you on your system?
One to 16.

2. How many of these yards are equipped with car retarders?
From the 14 roads replying, only 2 have yards equipped with car retarders, but many others are investigating with a view to installation.

3. Generally speaking, what volume of business justifies hump yard operation compared with flat yards?
This is dependent on (a) number of classifications made; (b) ratio of total cuts to total cars handled. Generally speaking, hump yard operation would be justified by 700 or more cars per day in and out with 15 or more classifications and a greater ratio of classification than 1:5, i.e., average of 20 cuts per 100 cars handled.

4. What train arrival frequency justifies a hump yard?
The conditions as to volume and classification as given in answer to previous question rather than train frequency are the determining factors. In general a train arrival frequency of one hour with 15 or more classifications will justify hump operation.

Question—How does the number of classifications per train combined with train frequency arrival affect the decision to use hump instead of flat yard switching?
The total volume per shift or per 24 hours, the number of classifications to be made regularly and the ratio of cuts to total cars handled are the determining factors. Flat switching cannot be performed economically when the number of classifications exceeds 20, as rehandling then becomes necessary.

Question—How does a mixed consist of trains and character of business affect the economy of hump yards?
The more mixed the consist of trains and the greater the number of classifications or cuts to be made the greater the efficiency of the hump yard as compared with the flat yard. With 60 or more cuts per 100 cars hump operation is three times as fast as flat switching.

7. How does frequency of service to patrons affect the practical use of hump yards?
The flexibility of hump yard operation exceeds that of the flat yard operation. For special delivery service short tracks can be provided.

8. How many cars per hour can be humped in a hump yard using one engine?
The number of cars, using one engine both for bringing the cars from the receiving yard and shoving them over the hump depends upon—(a) Number of riders assigned and facilities provided for their return to the hump. (b) Number of cars per train and number of cars per cut. (c) Design of yard with special reference to speed with which cars will clear the lead—and varies from 50 to 100 cars per hour. With two engines this can be increased approximately 25 per cent.

9. Are more than two engines justifiable in a hump yard per shift?
In general more than two engines working on one hump are not economically justified but are necessary at times to keep business moving currently.

10. What is the average maximum number of cars that can

be humped per 8-hour shift and what number of engines are necessary?

With one engine working on a hump from 400 to 800 cars; with two or more engines, 500 to 1,000 cars.

11. In the previous question, do all engines utilized have full ground crews?

As a general rule engines working on the hump have full ground crew but in a number of cases a conductor and one or two brakemen with car riders handle both engines.

12. What is the average maximum number of cars that can be classified in a flat yard per 8-hour shift and what number of engine hours is necessary?

The number of cars depends on the number and length of the classification tracks, the number of classifications to be made and the number of cars per cut as well as the amount of interference on the lead. With 15 to 20 classifications and 2 cars per cut, the number will vary from 125 to 300. Two or more engines will handle proportionately more if the design of the yard permits them to work without interference.

13. What per cent of the cars are weighed on the average?

This is purely a local operation and no general conclusion can be drawn.

14. How much is your car damage per 1,000 cars actually handled in yards for (a) Hump yard with car riders; (b) Hump yard, with car retarders, and (c) Flat yards?

The majority of the roads reporting show less damage to cars in hump yards than in flat yards. Replies give insufficient data to enable a comparison to be made with yards equipped with retarders.

15. How many cars per 8-hour shift per car rider are handled?

The number varies with the length of the classification yard, whether or not cars are ridden to coupling, facilities for the return of riders, the number of cars per cut and the number of engines assigned to the hump. The range is from 30 to 60 cars with 45 a fair average.

16. How many cars per 8-hour shift per car inspector are handled in hump yards?

The number varies between 60 and 320 with 200 as a fair average.

17. How many cars per 8-hour shift per skateman are handled in both retarder equipped hump yards and car rider hump yards?

The only answer received giving the number of cars per 8-hour shift per skateman shows 792. Other roads stated that they had done away with skatemen.

18. How many men per track mile are necessary to maintain (a) Hump yard with car retarders; (b) Hump yard with car riders; and (c) Flat yards?

There are so few retarder-equipped yards that no conclusion can be drawn. For other yards both flat and hump 0.5 men per mile of track is the general average.

19. From actual statistical data derived from your operations, what is the average cost per car handled in a (a) Hump yard retarder-equipped; (b) Hump yard with car riders; and a (c) Flat yard?

There are so few retarder-equipped yards that the data submitted do not permit a conclusion to be drawn. The answers submitted for other types of yard do not permit a conclusion to be drawn as to comparative costs.

20. Is the classification yard used as departure yard or is a separate yard provided? If the latter, describe briefly the method of handling cars from the classification track to departure yards.

The practice is about equally divided. Where departure yards are provided switch engines are used to shove or pull cars from the classification to the departure yard.

Appendix F—Railway Operation Affected by Motor Trucks and Bus Lines

Developments in Motor Coach Field

Since last year's report nothing has happened to indicate the advisability of changing any of the conclusions or recommendations. The growth of hard-surfaced roads and the increase in the number of motor vehicles of all varieties have continued unabated. The federal and state commissions continue to authorize the abandonment of unprofitable rail lines and railroad companies have made large increases in the size of bus and truck fleets.

Why are travelers using motor coaches more and more every year? At least three reasons may be given: (1) Economy, bus fares being usually well under railroad fares; (2) frequency of service; (3) convenience, the "store-door" principle having been applied to passenger service. For many of the railroad-coach passengers, the saving of 10 to 25 per cent of the highway time by use of rail transportation is of little importance, whereas the reduction in fare is important. Furthermore, a saving in time may result by using a bus that is ready to leave rather than by waiting several hours for the train. As far as comfort and enjoyment are concerned, much may be said on each side. The tendency is for greater comfort in motor coach designing, especially as regards the seating. In any case, it is thought that railroad operators should try to forget the old theory that novelty is the principal cause of bus-riding, at least for journeys exceeding 50 miles.

While the motor coach has drawn its patronage largely from the day-coach passengers, the recent installation of "super-de-luxe" motor coaches, with wider seats, better toilet facilities, buffet service, observation deck and more glass area in sides and rear, together with extra fares for the added comforts, indicates that strong efforts are being made to attract parlor car passengers. Where there is sufficient traffic to justify the expenditure, this situation is being met by faster rail schedules and more luxurious Pullman equipment.

As indicated in last year's report a railroad should give serious consideration to the use of rail motor cars or highway motor coaches wherever the use of one or both of these substitutes will result in larger net income or a reduction in loss. In some cases savings have been made by substituting rail motor cars for steam trains, and then further savings by the substitution of motor coaches for the rail motor cars. Emphasis is laid on the fact that the *maximum* economy should be obtained in one step; in other words, the saving resulting from the proposed substitution of rail motor cars for steam trains is no argument for the substitution unless it can be shown that no other transportation tool, such as a motor coach, will produce a greater saving.

A word of caution is offered those whose duty it is to determine the economy of providing some form of substitute service for unprofitable steam train operation: do not be misled by estimates of the cost of train operation that include high interest and depreciation charges. If the service is on a light traffic branch line where a small eight-wheel locomotive and one or two obsolete wooden coaches are used, the analyst should ascertain what use, if any, can be made of this released equipment if some substitute is provided. Often there is no place to use it, and with the continued abandonment of branch lines and the release of better equipment from the main line this condition will become more and more prevalent. In this case the determination of the cost of existing service, for the sole purpose of determining the economy of substituting some other form of service, should not include interest on the original cost or reproduction cost of equipment in service, but merely interest on its resale or scrap value. Similarly, depreciation may have accrued on the old equipment nearly or fully equal to its ledger value; to charge against the existing operation the full amount of depreciation for the class of equipment to which these old units belong is merely to mislead one's superiors as to the legitimate savings that are possible. On the other hand the investment in rail cars and motor coaches means new money, for which interest and depreciation may legitimately be charged. On lines where the daily mileage is small these fixed overhead items represent a considerable portion of the total mileage cost and the theoretical savings may be only the result of inaccurately figured fixed

charges. Regardless of the accountant's method of figuring costs for entirely different purposes, the analyst should confine himself to a practical, common-sense viewpoint.

Recently there has been an effort to bring back the steam-propelled rail car that was used with more or less success a generation ago. Several manufacturers are working on cars of this type and in a year or two it may be possible to purchase a "gas" car that uses liquid fuel under a boiler rather than in an internal combustion engine. Theoretically a steam car has many points of advantage when compared with a car propelled by a gas-engine, and if the technical details that surround the design of burner, boiler and high-pressure steam engine can be successfully worked out it may be necessary to revise our estimates of the cost of rail motor car operation. Railroad operating officers should follow carefully these new experiments in rail car design.

Motor Trucks

The use of motor trucks by railroads and independent operators continues to increase. While this form of highway competition is frequently unfair, the traffic diverted from the rail to the highway is usually short haul l.c.l. freight that adds little if any to the net income of the rail carriers. On the other hand, the motor truck has proved to be a useful ally to the railroads in terminal and suburban work. The use of containers for l.c.l. freight is increasing and in the handling of the containers motor trucks and trailers are finding a new field for service.

In an appendix to this report, the committee presented a copy of a paper submitted by H. F. Fritch, Passenger Traffic Manager of the Boston & Maine, to the transportation meeting of the Society of Automotive Engineers on October 27, 1927, entitled: "Rail Car or Motor Coach—The Economic Field of Each." It also presented a description of the Baltimore & Ohio's train-side service in the New York district.

Discussion

[The report was presented by the committee chairman, J. M. Farrin (I. C.).]

Chairman Farrin: During the past year the committee has had occasion to review a criticism of a report made by the committee in 1925, on the traffic capacity of a railroad. This report was criticized by H. Parodi, consulting engineer of the Paris-Orleans Railway of France and a member of this association.

Mr. Parodi differed somewhat in his analysis of this question, so the committee took upon itself the work of reconciling Mr. Parodi's criticism with the former report.

[The report on increasing track capacity was outlined by Subcommittee Chairman M. F. Mannion (B. & L. E.).]

J. P. Hanley (I. C.): I should like to suggest that the committee give specific study to the proposition of recommending the spacing of water stations with the idea of improving the movement of trains.

F. M. Patterson (*Railway Age*): I should like to inquire what the percent of grade was on the line covered by this study.

Mr. Mannion: The maximum or ruling grade I think was 1 per cent.

Mr. Patterson: I take it that the remote control was not used.

Mr. Mannion: No.

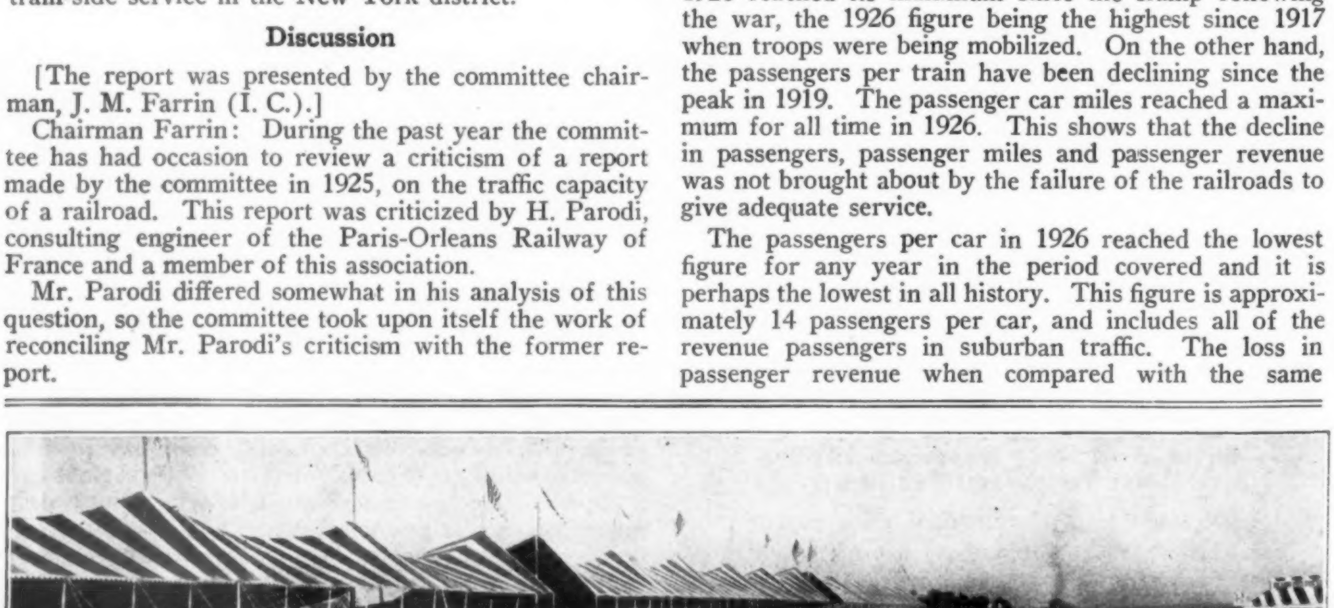
Mr. Patterson: Is not that one element that would improve or expedite operation?

Mr. Mannion: The committee had under consideration an installation of remote control switches which they had hoped to report on this year, but they have not been able to obtain information to make a complete report as yet.

[The report was accepted without further discussion and the report on motor trucks presented with the subcommittee chairman, H. C. Crowell (Penna.) outlining the subject in part, as follows:]

Mr. Crowell: Last year in addition to furnishing statistics that showed the encroachment of private and public automobile traffic on railroad passenger traffic and revenues, we made a study of what may be called the branch line problem. This year we have brought our revenue passenger statistics up to date and have stated briefly the competitive highway situation. The number of passengers carried reached its maximum in 1920 and has steadily declined to a minimum for the 11 years ending in 1926. As to the service the railroads are rendering to the public, passenger train miles in 1926 reached its maximum since the slump following the war, the 1926 figure being the highest since 1917 when troops were being mobilized. On the other hand, the passengers per train have been declining since the peak in 1919. The passenger car miles reached a maximum for all time in 1926. This shows that the decline in passengers, passenger miles and passenger revenue was not brought about by the failure of the railroads to give adequate service.

The passengers per car in 1926 reached the lowest figure for any year in the period covered and it is perhaps the lowest in all history. This figure is approximately 14 passengers per car, and includes all of the revenue passengers in suburban traffic. The loss in passenger revenue when compared with the same



And the Engineers Went Forth to Make a Railroad—The Engineers' Float Passing in Review at the B. & O. Fair of the Iron Horse

months in the preceding year was greater in 1926 than it was in 1925.

For the first time in many years the travel in parlor and sleeping cars declined, previous losses having been confined to the coaches, where the length of journey is comparatively short. It indicates that the motor coach rider is no longer solely a short rider, but that he has overcome enough of his prejudice toward motor coaches to make him a long haul rider also.

H. M. Stout (N. P.): It seems to me that this association would be a material loser if the committee's recommendation to discontinue the study were followed. I have in mind the impracticability of the Association following in an adequate manner the steps being taken in the evolution of passenger transportation without a report similar to that presented.

President Brumley: That will be referred to the Board of Direction.

[There being no further discussion the committee was excused with the thanks of the association.]

Report on Economics of Railway Labor

A. N. Reece (K.C.S.)
Chairman
G. M. O'Rourke (I.C.)
C. C. Cook (B.& O.)
J. C. Patterson (Erie)
Lem Adams (U.P.)
J. A. Heaman (G.T.W.)
W. S. Bennett
H. M. Stout (N.P.)
Cale Wamsley (M.P.)
J. D. Keiley (C.& O.)*
H. M. Church (C.& O.)
C. S. Joseph (A.& W.P.)
C. R. Caswell (C.P.R.)
F. S. Schwinn (I.G.N.)

A. N. Reece

F. M. Thomson (M-K-T)
Vice-Chairman
J. M. Sills (St.L-S.F.)
E. T. Howson (Ry.Age)
R. L. Schmid (N.C.& St.L.)
C. A. Ashbaugh (G.C.&S.F.)
Wm. Carpenter (B.& O.)
A. E. Botts (C.& O.)
John Evans (M.C.)
J. B. Mabile (C.R.I.& P.)
J. F. Dobson (B.& O.)
W. A. Murray (N.Y.C.)
H. A. Cassil (P.M.)
F. B. Doolittle (N.Y.C.)
W. S. Burnett (C.C.C.& St.L.)

*Died July 8, 1927

THE COMMITTEE presented reports covering the following subjects:

(1) The extent to which it is practicable to stabilize employment in the Maintenance of Way Department in the interests of efficiency and the necessary measures to accomplish it (Appendix A).

(2) Economy in the use of labor-saving devices (Appendix B).

(3) Standardization of motor car parts (Appendix C).

(4) Equating track values for labor distribution (Appendix D).

It recommended: (1) That the work of the sub-committee (Appendix A) be accepted as final and the subcommittee excused; (2) That the work of the sub-committee (Appendix B) be continued and consideration be given to reducing the number of labor-saving devices to be studied each year so as not to exceed two items in order to allow intensive study of the devices assigned; and (3) That the report in Appendix C be accepted as information.

Appendix A—Stabilization of Employment in the Maintenance of Way Department

After further study of its subject during the year, the committee reported that it had no changes to recommend in the information presented previously, and that its investigations had added strength to its conclusions reached heretofore. In order to bring this subject more forcibly before the members the committee submitted a resumé of the reports which it has presented during the last three years.

No single factor exerts a more direct influence on the efficiency in handling maintenance of way work than its orderly prosecution throughout the year. It is, therefore, essential that a budget be prepared and approved, based upon a program outlined sufficiently in advance of the budget, that will enable the materials to be assembled and forces organized for the proper execution of the year's work, and still more important, that all officers adhere as strictly to this program as possible in order to secure its full effectiveness.

It has long been recognized in industry that uniformity in volume of work and continuity in operations are essential to the maximum efficiency, and that as these decrease, the cost of work increases. The general practice on many of our American railways of making maintenance allowance from month to month to conform to the wide fluctuations in earnings exerts a very heavy toll on maintenance of way operations, by added costs due to decreased efficiency in the force employed. We believe that if the losses which result from this practice were more fully realized by all concerned, this policy would be discontinued.

The committee offered the following conclusions:

The equalization of expenses permits work to be done at the most economical time, seasonal and traffic conditions considered. It also prevents the distortion of operating ratios, while by its application more uniform forces may be employed in maintenance of way work, thereby tending toward stabilization of forces.

In consideration of the ultimate economy of building a strong personnel of labor forces and the immediate economy of holding experienced men in maintenance of way service, as much work as is economically possible should be done in the winter, thus stabilizing forces.

Minimum cost is secured through uniform production; reductions in manufacturing costs are directly

reflected in prices charged the railroads; stabilization of forces with the resulting increase in the uniformity of use of materials will lead to savings in the cost of materials over and above the savings effected directly through the increased efficiency of the forces.

The committee in its four-year study of this subject feels that it has covered the ground very thoroughly, and the more we have studied this matter of stabilizing employment, the more we are able to realize the economies, direct and indirect, that are to be obtained by having a trained force to perform our maintenance of way work, the same as we have for the maintenance of equipment.

We do not find that the average railway officer appreciates the fact that maintenance of way work requires trained men. Therefore, it should be to the interest of all concerned in maintenance of way work to sell this idea. with the end in view of ultimately obtaining a year-around experienced maintenance of way force.

Appendix B—Economy in the Use of Labor-Saving Devices

The committee continued its studies of the economies in the use of labor-saving devices and submitted a questionnaire to the railways of the United States and Canada for the purpose of ascertaining the economies resulting from the use of (1) Rail-handling devices; (2) Rail-oiling devices; (3) Advantages of using machines such as ditchers singly and in tandem; (4) Use of mechanical, air, and electrically driven tools.

The returns from this questionnaire indicated a lack of detailed information on the actual performance of the different machines. While many of the larger railways are using several or all of the different types of machines mentioned and claim economies from their use and operation, they were not in a position at this time to give definite facts and comparisons. In view of this, the committee recommended that it continue its work. It feels that a more limited number of machines should be investigated each year and believes that, by this plan, some definite information on the economies resulting may be assembled.

Appendix C—Standardization of Parts and Accessories for Motor Cars

The activities of the sub-committee have been confined to an endeavor to enlist the aid of the manufacturers in the consideration of standardization of parts and accessories of railway motor cars. The committee has nothing to show for its efforts, except the assurance of the manufacturers that they will work with us.

A meeting of the Manufacturers' committee, or their representatives, was held on September 21, and they wrote the committee advising that they had made a thorough investigation and compiled a report and that this report, if approved by the manufacturers—as they expect it to be—would be furnished the committee.

The report of the manufacturers was not available at the last general meeting of the committee; hence your committee feels there is nothing to do but to report progress.

Appendix D—Equating Track Values for Labor Distribution

In the report of 1922 the committee suggested a definite list of comparative values for reducing the various physical features of track to the equivalent of one mile of first main track. This table of values was derived from actual costs extending over a period of years for a main line division, which was the subject of special study. The values were as follows:

One mile of first main track equivalent to:

1.15 miles of second main track
1.33 miles of third or fourth main track
2.00 miles of branch line track
2.00 miles of passing and thoroughfare track
3.33 miles of yard tracks
12 main track switches
20 side track switches
10 railroad crossings
12 city street crossings
25 to 50 country road crossings
One-half mile of track pans
4 miles of ditches

For the purpose of elasticity in the application of these values to meet the changing conditions of various elements of the track, it was suggested that the condition of the main elements per section be stated monthly and a "Condition per cent" of the whole section determined. This result, applied to the equivalent mileage, as determined from the table of values referred to, gave the equated mileage for the section. The ratio of the equated mileage of the section to the total equated mileage of the division determined the number of men allotted to the section from the total number of men allotted the division.

In order to determine the necessity or desirability of equating additional features of track maintenance for use in labor distribution, a questionnaire was issued to 57 member railways requesting information as to the results of the application of the suggested method of force distribution. Replies were received from 26 railways, 14 of which advised that they do not equate track values for the purpose of distribution of track labor, and 12 advised they do equate track values for that purpose. None uses the "Condition per cent" in determining the equated mileage. If the 12 railways reporting the use of equated mileage, 4 use the items suggested by the committee, 4 use a less number of items and 4 use a greater number. These 4 railroads equate 32 additional items, not one of which is common to the 4 railways. Two items are common to 3 railways and only 8 items are common to 2 railways.

Consideration of the replies to the questionnaire and deliberation of the committee lead to the conclusion that no extension generally is necessary or desirable in the number of features to be equated. It is evident that there are peculiar features of maintenance on individual railroads that affect the force required and railroads having such peculiar features should add them to the above list and apply values thereto which they deem proper.

It is well known that the work necessary to be performed on a section will vary from year to year, due to the changing conditions of various elements of the track and the committee endeavored to compensate for this by suggesting a "Condition per cent."

It appears that judgment enters so largely into any distribution of labor that it is desirable, if possible, to find some method of aiding judgment or an accurate substitute for that judgment.

There are several elements in the problem (1) the physical units, (2) condition of the units, (3) use of the property and (4) characteristics of the railway as to curvature and grades. As to the first item, physical units, the units heretofore suggested are considered sufficient. As to the second item, condition of units, the report of the committee presented in 1922 gave in Exhibit "J" a method of arriving at the "Condition per cent" which could be applied to the equated mileage for each section so as to give an equitable distribution of labor. As to the third term, use of the property, the

committee presented a study made on a railroad in the west to determine the effect upon labor costs of maintenance due to volume of traffic and speed. It was first determined that 40 per cent of the maintenance labor was not affected by traffic, the basis of which was the following:

Kind of Work Not Affected by Traffic	*Relation to Total Maintenance Labor. Per Cent*
Grassing track and cutting sod line	5.01
Mowing and burning right-of-way	2.69
Dressing ballast shoulder	2.52
Cleaning ditches	2.33
Bridges, trestles and culverts	0.43
Repairing right-of-way fences	1.08
Repairing stock guards and wing fences	0.70
Repairing crossings and signs	1.15
Care of station grounds and buildings	1.79
Caring for switch lamps in yards	0.84
Caring for switch lamps outside of yards	1.91
33 per cent of tie insertions	2.69
25 per cent of lining and surfacing	2.50
25 per cent of rail laying	0.54
33 per cent of spotting	5.51
50 per cent of tightening bolts	1.02
50 per cent of patrolling track	1.93
25 per cent of miscellaneous and other labor	4.95
	39.59

In figuring the man-factor we start with the basis of .40, this being the labor unaffected by traffic. Factors are then built up as follows:

Minimum maintenance labor not affected by traffic	0.40 per cent
Per million gross tons of freight per mile of track	0.03 per cent
Per 5,000 cars of passenger equipment	0.01 per cent
Per 8 miles of maximum speed	0.01 per cent

For example, assuming that a given stretch of track handles 10,000,000 tons gross freight per mile per year, 20,000 cars of passenger equipment, and is limited to 60 miles per hour speed, the traffic factors would be as follows:

Minimum not affected by traffic	0.40 per cent
Freight traffic, 10,000,000 tons at 0.3 per million	0.30 per cent
Passenger traffic, 20,000 cars at 0.1 per 5 million	0.04 per cent
Speed, 60 miles per hour	0.08 per cent
Classification factor	$0.82 per cent

Making an assumption that one man per year is necessary to maintain one equated mile of track, 100 equated track miles would require 0.82 times 100 equals 82 men.

In order to make a check on this method, it was applied to a portion of a trunk line railroad in the east on which the data were available with the following results:

Division	*Main Track Miles*	*Gross Tons per Mile of Main Track*	*Pass. Cars per Mile of Main Track*	*Speed*	*Equated Miles*	*Man Factor*	*No. of Men Required*	*No. of Men Standard Basis in Use*
A	449.32	5,669,520	38,000	60	726.45	0.72	523	550
B	67.63	539,800	33,400	60	109.36	0.56	61	66
C	42.90	451,000	41,850	60	63.67	0.57	36	45
D	206.50	11,748,600	37,600	50	252.16	0.89	224	211
E	110.41	6,176,171	3,985	60	187.04	0.67	125	146
F	274.00	15,945,500	30,685	60	400.13	1.01	404	365
G	64.74	273,200	3,720	40	86.39	0.47	41	41
H	142.61	1,040,000	8,400	50	196.40	0.51	100	98
I	220.00	5,430,000	7,332	60	364.82	0.65	237	247
Total	1,578.11				2,386.42		1,751	1,769
Figures for territory as a whole:								
	1,578.11	7,250,473	25,876	60	2,386.42	0.74	1,766	1,769

The above result checks as close as any average could be expected to check and being applied on railroads in entirely different territories with different traffic conditions would appear to verify the method proposed.

Having determined the proper working force, the seasonal distribution of the force allowed for the year is necessary. Some railroads make a distinction between summer and winter forces and accomplish this by varying the man-basis per mile of equated track. Another method used by a railway is to determine the man allowance for the year total and apportion five per cent of this total for each of the months of January, February and December; seven per cent for the month of March; nine per cent for each of the months of April and November, and ten per cent for each of the months of May and October, inclusive. This method, while satisfactory in the territory in which applied, would vary according to the geographical location of each railroad, due to climatic conditions and changes in periods of working season. The method outlined is quoted as an example of the principle of allotting the maintenance labor on basis of seasonal requirements.

As to the fourth item, characteristics of the railway as to curvature and grades, it is the intention of the committee to give further study to that feature for the purpose of establishing the value it should have in the equation.

Discussion

[The report was presented by the committee chairman, A. N. Reece (K. C. S.) with Past-President J. L. Campbell (S. P.) presiding. The report on expenses was received without discussion following which the report on labor saving devices was presented.]

R. H. Ford (C. R. I. & P.): The subcommittee states that it has been unable to do much on this report because of lack of information. I think any engineer who has followed construction in the last 10, 15 or 20 years must be struck with the tremendous changes in reducing costs by mechanical means. Either the railroads are still continuing with antiquated means of maintaining their roads or they are not yet familiar with the devices they have. If the latter is true, the chances are that they are handling them in an expensive and improper manner. It occurs to me that it would be helpful if several roads were picked out and held up as a shining example of how they are handling their work.

Hunter McDonald (N. C. & St. L.): As a representative of a road that has made extended use of a number of labor-saving devices, I think I can offer some explanation of why it is difficult to evaluate the savings brought about by these machines. The chief difficulty is to value the liability of the machine when it is lying idle. Many of these machines cannot be used all the time. Another difficulty is that on some divisions, the use of these machines is interfered with by traffic.

F. R. Layng: The trend of this discussion might lead some to think that the railroads have been negligent in this work. That would be an unfortunate impression. The facts are that we have made remarkable progress.

W. H. Kirkbride (S. P.): A good many of the machines are in the experimental stage. Therefore, persons must be careful and conservative in arriving at conclusions.

W. C. Barrett (L. V.): We have used labor saving devices longer than any other railroad, and I can say emphatically that they have been economical. One of the reasons why we keep our cost of maintenance per track mile down where it belongs is that we have done everything we possibly could with labor saving devices. One speaker mentioned that some of the machines would lie idle. By using a locomotive crane for laying rails and almost everything else, we keep it busy

all the time. We have to schedule it in order to have the crane available. There is not lost motion on our railroad through the use of labor saving devices.

W. P. Wiltsee (N. & W.): I should like to suggest to the committee that it consider labor saving devices that will operate off the track. Some roads with heavy traffic are getting too many machines on the road to operate long enough to make them economical.

[The report on devices was accepted without further discussion, also the report on motor cars, following which Subcommittee Chairman J. M. Sills (St. L. S. F.) presented the report on labor distribution.]

Mr. Sills: There is one point I would like to bring out in connection with this report and it is that this is not a definite mathematical way of distributing money, but simply an aid to judgment which possibly in some cases is based on guesswork. It is thought that the railroads can better the manner of distributing money by introducing some formula such as we have tried to develop.

H. C. Crowell (Penna.): On this particular western road mentioned, about 40 per cent of the labor expenditures for maintenance of the track did not vary with the traffic, and this 40 per cent has been used in working out a problem on an entirely different railroad. No doubt 40 per cent is perfectly proper for the road referred to, but if we are going to deal in averages I suggest we get back to a formula of the Committee on Economics of Railway Operation, in which it was demonstrated, with reasonable accuracy, that on the average about one-third of all expenditures do not vary with the traffic. Also the words "per million gross tons of freight per mile of track," should read, per million gross ton miles of freight per mile of main track per annum, which is quite a different thing.

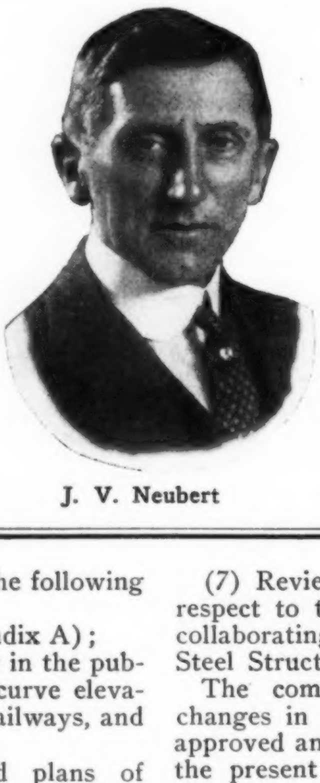
Also "per 5,000 cars of passenger equipment" should read, "per 5,000 car miles of passenger equipment per mile of main track per annum." Cars and car miles and tons and ton miles are two different things.

The formula works out so well that it might almost be distrusted. It shows that 1,766 men were required for the territory as a whole, when there were actually 1,769. I would suggest that the committee apply this formula to a road that has heavy passenger traffic, and then likewise to another with heavy freight traffic, and see how well it will work out.

[There being no further comments the report was accepted and the committee excused with thanks.]

Report of the Committee on Track

J. V. Neubert (N.Y.C.)
Chairman
J. B. Akers (Sou.)
W. G. Arn (I.C.)
W. H. Bevan (C.N.R.)
C. W. Breed (C.B.& Q.)
H. W. Brown (Penna.)
W. G. Brown (F.E.C.)
E. W. Caruthers (Penna.)
H. G. Clark (C.R.I.& P.)
J. W. DeMoyer (Reading)
J. E. Deckert (Cons.Engr.)
L. W. Deslauriers (C.P.R.)
E. B. Entwistle (J.& S.C.)
J. M. Fair (Penna.)
C. J. Geyer (C.& O.)
F. S. Hales (N.Y.C.& St.L.)
W. J. Harris (C.B.& Q.)
O. F. Harting (T.R.R.A.of St.L.)
E. T. Howson (Ry.Age)


J. V. Neubert

C. R. Harding (S.P.)
Vice-Chairman
T. T. Irving (C.N.R.)
H. D. Knecht (M.P.)
E. R. Lewis (M.C.)
J. deN. Macomb (Inland Steel)
F. H. Masters (E.J.& E.)
C. M. McVay (N.Y.C.)
J. C. Mock (M.C.)
J. B. Myers (B.& O.)
A. J. Neafie (D.L.& W.)
G. A. Peabody (Clev.F.& C.Co.)
W. H. Petersen (C.R.I.& P.)
O. C. Rehfuss (Can.Steel Fodrs.)
I. H. Schram (Erie)
G. J. Slibeck (Pet'bone Mulliken)
G. M. Strachan (A.T.& S.F.)
J. B. Strong (Ramapo Ajax)
E. D. Swift (Belt Ry.of C.)
J. R. Watt (L.& N.)

THE COMMITTEE reported on the following subjects:

(1) Revision of Manual (Appendix A);

(2) Review of material now appearing in the publications of the Association relating to curve elevation, ascertain existing practices of the railways, and recommend changes (Appendix B);

(3) Continue the study of detailed plans of switches, frogs, crossings and slip switches, including self-guarded frogs (Appendix C);

(4) Continue the study of track construction in paved streets (Appendix D);

(5) Design and specifications for foundations under railway crossings, also proper methods for tie spacing and timbering under railway crossings (Appendix E);

(6) Report on methods of reducing rail wear on curves, with particular reference to oiling the rail or wheel flanges, collaborating with Committee IV—Rail (Appendix F);

(7) Review material in former proceedings with respect to the cause and effect of brine drippings, collaborating with Committees on Rail and Iron and Steel Structures (Appendix G).

The committee recommended: (1) That the changes in the Manual outlined in Appendix A be approved and that revised version be substituted for the present recommendations in the Manual; (2) that the conclusions in Appendices C, D and E be adopted as recommended practice and published in the Manual; (3) that further data as outlined in Appendices C and E, also reports as outlined in Appendices B, F and G, be received as information only.

Appendix A—Revision of Manual

The committee recommended that all future plans and specifications of the Track Committee have the initials "A. R. E. A." placed thereon in a conspicuous manner, preferably above the main title; withdraw plan No. 953, details of movable point cross-

ings, angles 8 deg. 10 min. to 15 deg. 30 min., inclusive, dater November, 1926, adopted March, 1927, and substitute plan of the same number entitled A. R. E. A. details of movable points for curved crossings, angles 8 deg. 10 min. to 15 deg. 30 min., dated revised November, 1927; and withdraw plan No. 983, solid manganese steel frogs for 7 in. and 9 in. girder rails, dated November, 1926, adopted March, 1927, and substitute plan of the same number entitled A. R. E. A. solid manganese steel frogs for 7 in. and 9 in. girder rails, dated revised November, 1927.

It also recommended a number of specific changes in plans and specifications already in the Manual, and the withdrawal of index pages 1, 2, and 3, dated March, 1927, and the substitution of index pages 1, 2, 3 and 4, dated March, 1928. The committee reported that it has under consideration a new set of dimensions for heavy sections of rail and plans to submit them at a later date.

Appendix C—Plans of Switches, Frogs, Crossings, Double Slip Switches and Self-Guarded Frogs

The plans presented in this appendix and the revisions to the Manual in Appendix A coming under this subject were prepared in conference with the Standardization Committee of the Manganese Track Society. Following a number of explanatory remarks relative to plans previously submitted, and to new plans, the committee recommended that the following plans be adopted as recommended practice and printed in the Manual:

Plan No. 775, solid manganese crossing.

Plan No. 955, details solid manganese knuckle rail for Nos. 8 and 10 slip switches.

Plan No. 600, rules for laying out rail bound manganese frogs.

Plan 609, Nos. 9, 12 and 14 rail bound manganese frogs.

Plan No. 610, Nos. 15 and 18 rail bound manganese frogs.

The committee also recommended that Plan No. 343, No. 8 self-guarded rigid bolted frog, submitted with its report, be received as information.

Appendix D—Track Construction in Paved Streets

The plans presented in this appendix coming under this subject have been prepared in conference with the Standardization Committee of the Manganese Track Society. The committee presented for adoption as recommended practice, and for publication in the Manual, a series of plans of iron bound manganese center frogs for 7 in. and 9 in. girder rails, as follows:

Plan No. 984, A. R. E. A. Nos. 4 and 5 frogs, iron bound manganese steel center for 7 in. and 9 in. girder rails.

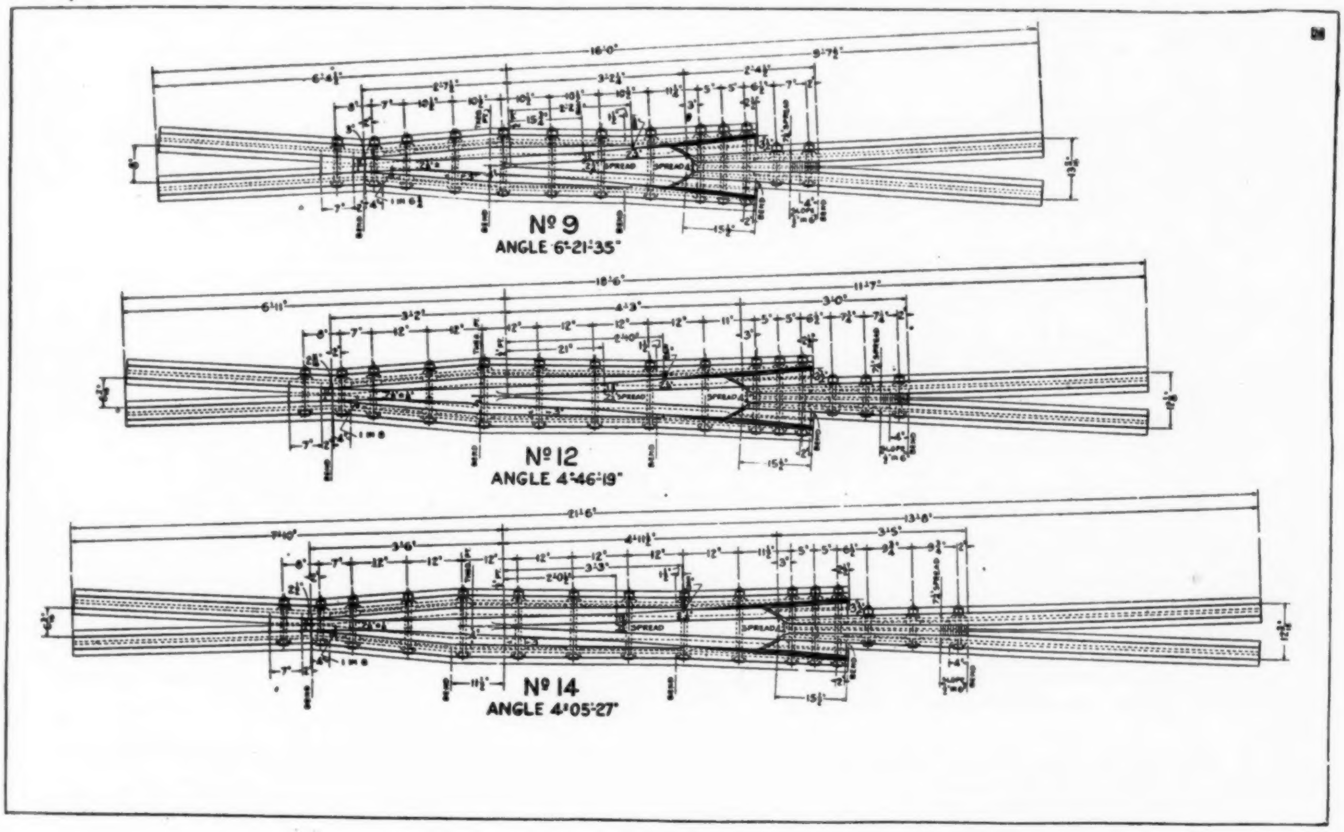
Plan No. 985, A. R. E. A. Nos. 6 and 8 frogs, iron bound manganese steel center for 7 in. and 9 in. girder rails.

Plan No. 986, A. R. E. A. No. 10 frog, iron bound manganese steel center for 7 in. and 9 in. girder rails.

The committee reported that it has under consideration plans for grooved tongue switch and mate for industrial tracks and connected tongue switch for main line use for presentation at a later date. It stated that plans for iron bound manganese insert crossings were also under consideration for presentation at a later date.

Appendix E—Foundations Under Railway Crossings

The plans presented in this appendix have been



Nos. 9, 12 and 14 Rail Bound Manganese Steel Frogs, Recommended for Adoption

prepared in conference with the Standardization Committee of the Manganese Track Society.

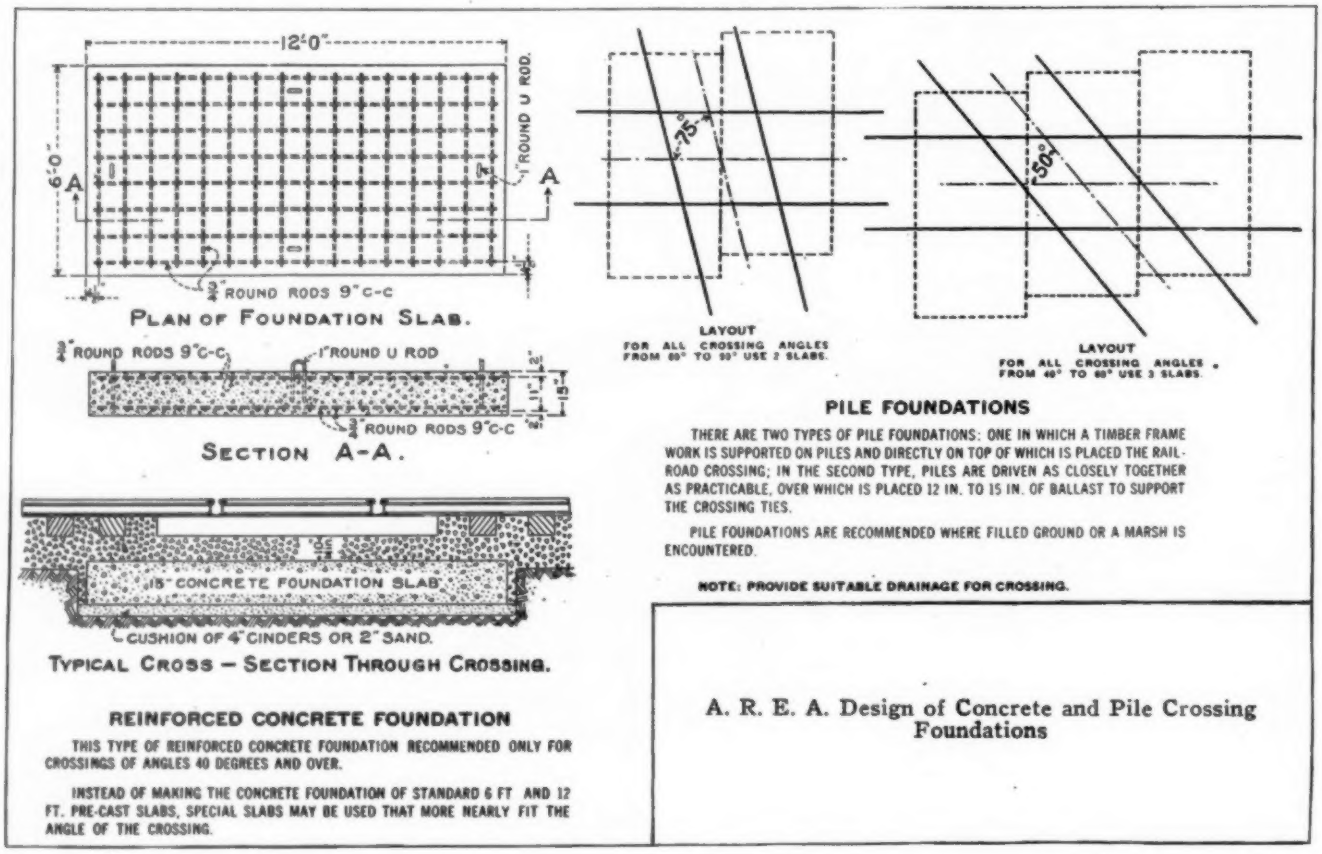
Plan No. 721, dated revised November, 1927, entitled A. R. E. A. design of reinforced concrete and pile crossing foundations, was offered for adoption as recommended practice, revised to include additional notes as to details and as to pile foundations. The following series of plans showing tie layouts for crossings were presented as information to invite criticism:

Plan No. 719-A, A. R. E. A. tie layout for railroad crossings, angles 8 deg. 10 min. to 14 deg. 15 min.

Plan No. 719-B, A. R. E. A. tie layout for railroad crossings, angles 14 deg. 15 min. to 25 deg.

Plan No. 719-C, A. R. E. A. tie layout for railroad crossings, angles 25 deg. to 50 deg.

The committee reported that it has under consideration plans of tie layouts for crossings of angles 50 to 90 deg. for presentation at a later date.



A. R. E. A. Design of Concrete and Pile Crossing Foundations

Appendix F—Methods of Reducing Rail Wear on Curves

There seems to be no question but that desirable economies can be effected by rail and flange oiling and roads which have taken up this practice claim considerable saving through it. Wear on the high rail of the curve is greatly reduced, life of ties is lengthened due to less re-gaging, less tread wear occurs on the low rail, curve resistance is lessened and there is reduced wear on flanges.

To secure proper results from oiling, it is essential that the proper oil be used. The viscosity of the oil is important, as the oil must be sticky enough to adhere to the flanges for application to the rail ahead and must function through a considerable temperature range. It is also essential that the oil be continuously applied, either to the wheels of every train using the track or to the rail ahead of every train, as less frequent applications of oil are not satisfactory.

The committee recommended that its report be received as information only and that the subject be continued, collaborating with the Committee on Rail.

Appendix G—The Cause and Effect of Brine Drippings

The committee reported that a review of the material in former proceedings yielded only the following of interest: In 1911 the Sub-committee on Brine Drippings made certain recommendations, and the proceedings of 1926 (Volume 27, page 467) give an interesting report of the effect of brine drippings on track appliances, but the data are not conclusive.

It reported that information recently obtained shows that the practice of using salt in refrigerator cars other than meat cars is increasing, it being used in the shipment of certain berries, other fruits, melons, vegetables, fish, poultry and dairy products. It is anticipated that the use of salt in cars other than meat cars will continue to increase, and as a consequence brine drippings will continue to damage rail, track fastenings, bridges and interfere with signals unless protection is provided.

Information obtained from various railroads indicates that no one protective coating has been found which is entirely satisfactory. Among the coatings which have been used more or less successfully are the following: Crude oil, asphalt and asphalt compounds, tar and tar compounds, and mastic paint.

A possible solution of this problem is the use of some refrigerant other than ice, preferably one which has no deleterious effect on refrigerator cars, track structure and the products which are being shipped. One such possible refrigerant is solid carbon dioxide (so-called "Dry Ice"). The cost of this material is

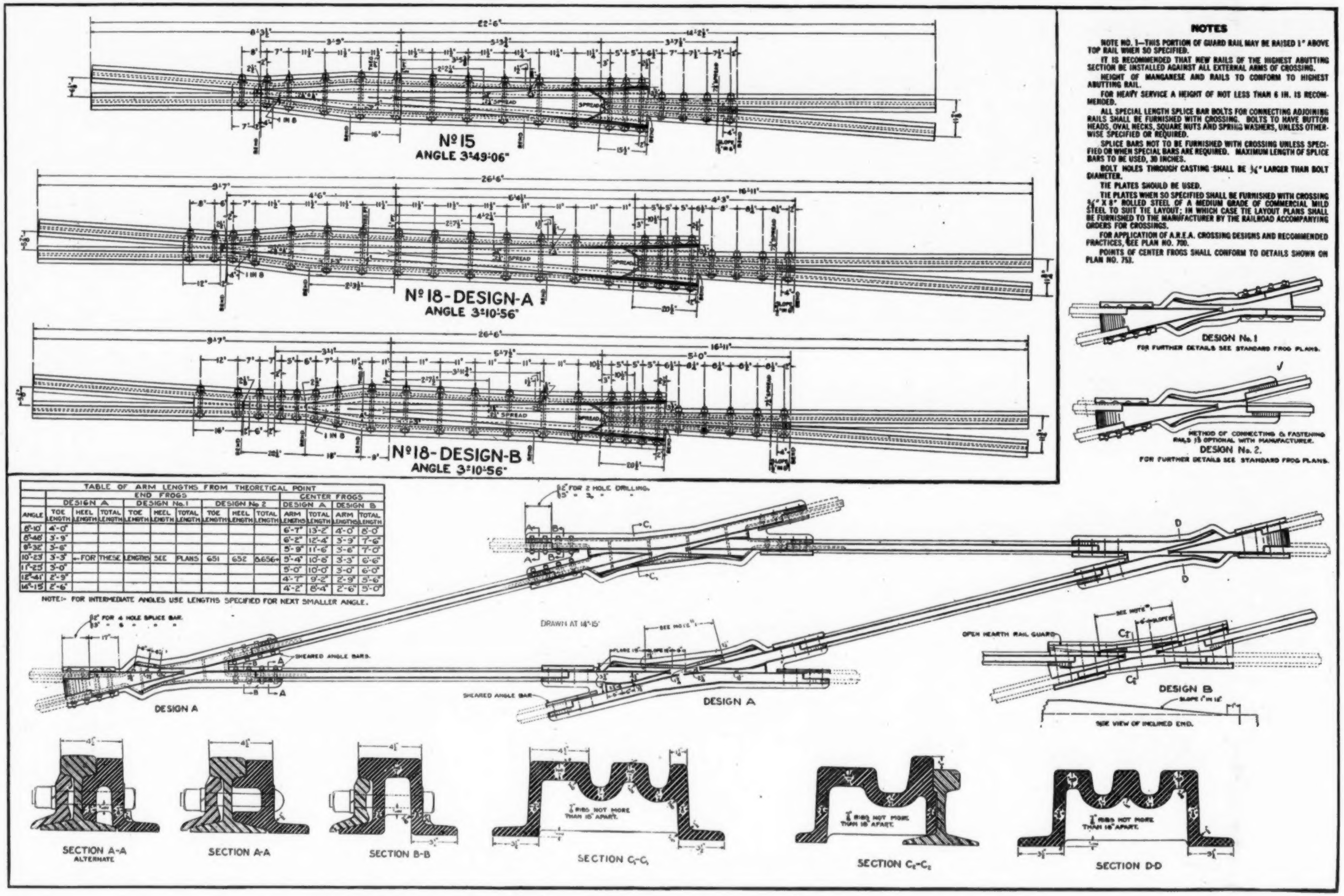


TABLE OF ARM LENGTHS FROM THEORETICAL POINT

	END FROGS									CENTER FROGS			
	DESIGN A			DESIGN No. 1			DESIGN No 2			DESIGN A		DESIGN B	
ANGLE	TOE LENGTH	HEEL LENGTH	TOTAL LENGTH	TOE LENGTH	HEEL LENGTH	TOTAL LENGTH	TOE LENGTH	HEEL LENGTH	TOTAL LENGTH	ARM LENGTHS	TOTAL LENGTH	ARM LENGTHS	TOTAL LENGTH
8°-10'	4'-0"									6'-7"	13'-2"	4'-0"	8'-0"
8°-46'	3'-9"									6'-2"	12'-4"	3'-9"	7'-6"
9°-32'	3'-6"									5'-9"	11'-6"	3'-6"	7'-0"
10°-23'	3'-3"	←FOR	THESE	LENGTHS	SEE	PLANS	651	652	&656→	5'-4"	10'-8"	3'-3"	6'-6"
11°-25'	3'-0"									5'-0"	10'-0"	3'-0"	6'-0"
12°-41'	2'-9"									4'-7"	9'-2"	2'-9"	5'-6"
14°-15'	2'-6"									4'-2"	8'-4"	2'-6"	5'-0"

NOTE:- FOR INTERMEDIATE ANGLES USE LENGTHS SPECIFIED FOR NEXT SMALLER ANGLE.

Upper—Nos. 15 and 18 Rail Bound Manganese Steel Frogs, Recommended for Adoption
Lower—Solid Manganese Steel Crossing with Interior Connecting Rails, Recommended for Adoption

as yet so high that its use as a substitute for ice and salt or ice alone may not be justified, but the satisfactory results obtained from its use and the increasing extent of its use promise increased manufacturing facilities with a possible decrease in cost, which makes it a promising possibility for refrigerator car shipments.

Discussion

[The report was presented by the committee chairman, J. V. Neubert (N. Y. C.) and his motion that *the modification of the Manual as recommended in Appendix A be adopted was carried,* following which the report on curve elevation was introduced.]

B. R. Leffler (N. Y. C.): The assumption is made in the Manual that the equipment moving into the curve is composed of a rigid, solid body. My study leads me to believe that this is fundamentally wrong. The object that moves over the curve is not a solid body, but is composed of two solid bodies connected by an elastic medium, this elastic medium being the spring carrying the cargo load. When the equipment was small, the assumption of two solid bodies connected by an elastic medium was not of much importance as compared with present day equipment and led to no serious error in determining the superelevation of curves. If the committee would make a study of this idea, it will reach some surprising results, in particular on sharp curves, with a superelevation corresponding to that given in the Manual. With equipment having a high center of gravity, the vibrations of swaying will actually lift the outer wheels off the rail. That will be particularly true at speeds, say, much below the elevation requirements, 15 or 20 miles an hour. Too much elevation may be the cause of derailment.

The committee should also make a study of the effect of lateral forces on track caused by swaying equipment. For instance, when a locomotive or car sways, the center of gravity moves to the right and left. It is a well known principle that you cannot move the center of gravity of a body without exerting a force. That means that all swaying equipment exerts a lateral force on track. I studied this with the conclusion that the swaying of a 70-ton hopper car will exert a 9,000-lb. lateral force on the track. It does not make any difference whether it is a curve or tangent. It is one of the most destructive forces.

My study leads me to conclude that most curves, sharp curves in particular, are elevated too much for the equipment ordinarily operated. It may be that it is advisable to let the rail wear and remove the outer rail rather than attempt to elevate too much and reduce the wear. If you elevate too much you get the wear on the lower rail anyway, depending on the proportion of slow movements.

Louis Yager (N. P.): There have been some serious derailments in recent years, the explanation of which has been baffling, and I am much impressed with the suggestions that have been made by Mr. Leffler.

Hunter McDonald (N. C. & St. L.): My experience has led me to believe that the much larger number of derailments occur from having too much superelevation rather than too little. I do not know of any derailment that ever occurred, wherein I was satisfied that the derailment was due to lack of superelevation. I believe derailments of that type would exhibit an overturning of the train, and not the phenomenon of flanges mounting rail.

W. H. Kirkbride (S. P.): You can make mathematical calculations for the elevation of a curve, but you must consider from a practical point that you are dealing possibly with combined traffic on a single-track railroad. You must strike a compromise and make curves safe for the passenger movement and safe for the operation of freight trains. If you put too much elevation in the curve, a box car is going to derail. The committee can well consider the safety of applying the principle of keeping the resultant of forces within the center third of the track, and it is my further thought that in enunciating any rule for elevation, we should establish tables dealing with the maximum speeds on curves for different superelevation of the outer rail.

C. W. Baldridge (A. T. & S. F.): I have studied two derailments which it was practically certain were due to speed in excess of the superelevation. The first occurred with a light engine going west, upgrade. All trains ordinarily were able to run not to exceed 25 or 30 miles per hour, and the curves were elevated accordingly. This engine was estimated as going about 70 miles an hour. It reached the end of a curve elevated for 25 or 30 miles an hour and left the track without turning over sidewise, although it went off on a fill of at least 20 ft. A few years later we had a double headed passenger train which was run at excessive speed and struck an 8-degree curve, when both engines were derailed, and it was unquestionably due to spee considerably greater than the curve was elevated for.

W. H. Courtenay (L. & N.): We have reason to believe that two engines were overturned bodily on the outside of the curve by excessive speed. One of them was a light section of a fast passenger train on a 2-degree curve. The other was a light regular train on a 12-degree curve.

Mr. McDonald: I do not think the two cases cited at all prove the rule. One of them shows where the engine derailed on a tangent after having passed the curve. That was possibly due to the excessive high speed setting up lateral vibration and causing the flange of the wheel to knock the track.

Mr. Leffler: I would like to ask Mr. Baldridge whether these tracks were properly tapered.

Mr. Baldridge: They were. It is our uniform practice to use easement curves and in both cases these derailments were at the beginning of the curve.

[There being no further discussion, the report on superelevation was received as information. The recommendation concerning the adoption of switch work plans was outlined by C. R. Harding (S. P.), who stated that the suggested change in title of Solid Manganese Steel Crossings would be made by the committee, following which it was voted to include the plans in Appendix C in the Manual. The report on the design of foundations under railway crossings was presented by O. F. Harting (T. R. R. A. of St. Louis), chairman of the sub-committee, and after some discussion the motion to *remand the report to the committee was carried.* The report on brine drippings was then presented.]

W. H. Courtenay (L. & N.): I would like to suggest a different recommendation from that recommended by the committee. That immense damage to bridge structures and track materials is done by brine drippings from refrigerator cars is well established, but the money equivalent of such damage is difficult to ascertain. The logical way to stop this

destruction is to stop the cause, that is, so to modify the cars which carry brine as to enable them to retain it until it may be emptied at certain designated places.

All efforts to protect bridge steel from corrosion by brine by the application of paints of various kinds, or special so-called anti-rust coatings of various kinds appear to have been futile, and it would be impracticable to attempt to apply coatings to the heads of all the spikes, to the tie plates, splices, bolts, rails and other steel in the track structure even if an effective coating material were developed.

Apparently the best method to stop this very serious damage to property is to prevail upon all of the railroads to decline to accept cars with salted ice which are not equipped with efficient brine retainers from which the brine may be emptied at designated points. The earnest co-operation of the American Railway Association should be enlisted, and I, therefore, *make a motion that this important matter be referred to the Board of Direction of this association.*

Mr. McDonald: I want to endorse all that Mr. Courtenay has said in regard to his experiences; we have endeavored to meet the problem. We spray our track with crude oil containing a high percentage of asphalt. I think we have been pursuing that plan for two years and I believe we are getting fairly tangible results.

Mr. Courtenay: I would like to say we have applied oil liberally during the past few months. We follow the practice on all of our girders and where we have steel track stringers attached to floor beams, we cover the top of the floor beams and track beams with creosoted timbers about 4 in. thick, and wider than the steel members they cover. They afford considerable protection but I noticed very recently on one of our bridges in the South, that the brine has been getting underneath by capillary attraction. You will find the rust far worse under the ties than anywhere else.

W. G. Arn (I. C.): The railroads were not canvassed to see how many of them enforced this rule about retainers, but I consulted the various departments on our own railroad, and they referred me to the Federal Ice Refrigerating Company as one of the largest re-icing outfits, and they said to the best of their information the rule was enforced about 95 per cent. One of the railroads objected to the use of ice in cars without retainers and took the matter to the Interstate Commerce Commission. The commission ruled that they must transport the cars with the salt on the ice even though they were not equipped with the brine tanks and intimated that if necessary the railroad companies could increase the rates enough to take care of any damage that might occur.

B. R. Leffler (N. Y. C.): The term 95 per cent is too cheerful. There is another matter that we should have no delusion about, and that is protective coatings. I made a repeated test by taking small pieces of metal, coating this metal with various compounds, including common red lead paint and linseed oil, dipped it into the salt solution taken out of the refrigerator cars; kept it in there 24 hours, then exposed it to the weather, and kept it for six months or a year, and not one of these so-called compounds amounted to anything. Ordinary common red lead and linseed oil paint showed up the best. The only compound I ever found that would hold up was hot asphalt applied carefully with all conditions just right, such as are seldom found in the actual application of paint. The solution of this difficulty is to get rid of the brine. The bridge engineers are attempting to take care of it in their way by making the sections of considerable excess area. I think the only solution to the problem is so to design and build the bridges that the brine will not reach the steel.

[*The motion to adopt the report was put and carried.*]

G. H. Tinker (N. Y. C. & St. L.): I think that the remedy proposed by Mr. Courtenay will be futile. That has already been done. The committee has reported the result, that nothing has been accomplished, or very little.

P. T. Robinson (S. P.): It is assumed that the conclusions of the committee were based on the outlets of the brine from the present position, which in most cases is over the journal and directly over the track. In Arizona the temperature of rail gets as high as 150 deg. We found there was a destructive force working on the ends of the untreated ties, to such an extent they were becoming badly broken, the spikes would not hold, and the life of the ties shortened up as much as three and four years. We found that when a long refrigerator train went by, there was a constant dripping on the ends of these ties. The refrigeration company on the Pacific Coast Express saw the point, and now as the cars go through the shops, they are changing them so the outlet is to the outside of the car. So far as the improvement on the end of the ties is concerned, although we changed to a creosote and oil tie. I cannot say whether it is accomplishing anything in that respect, but the oil holds the particles of the wood fiber together and does not permit the expansion and contraction that occurred before. [There being no further discussion the committee was excused with thanks.]

Another View of Early Engineering from the Rock Island's Collection

Little Rollo and His Pop*

Chapter III. In which the wandering pair proceed to the Coliseum and Rollo sees much of interest, as indeed, who would not?

POP was not any too chipper when he arose yesterday morning. After the movie Tuesday night he met several of his old cronies and they sat around talking shop until the wee small hours of the morning. But, promptly at the stroke of six, little Rollo was up and around, and, as usually happens, when the young son is up and around, there is no sleep for dad.

"Well, my boy," said Pop, "this is the day we visit the show at the Coliseum."

"Hooray," shouted Rollo, in his boyish enthusiasm, "and will we see the Roman emperors and the Christians fighting lions and the gladiators?"

"No," answered Pop surprised, "where did you ever get such an idea as that?"

"Why our history teacher told us all about the Coliseum just last week."

"Oh, I see," answered Pop, "but this is a different Coliseum. True, there are no lion fighters at this Coliseum, although we may see a lot of fellows throw the bull. Even though you'll see no Christians fed to the lions, I think you'll have a good time."

"Shucks," said Rollo, "I don't think I'll have a good time."

But Rollo was wrong, all wrong, as anyone knows who has been down to the show. He did have a good time, a rip-snorting time in fact.

No sooner had they entered the door, than his eye was caught by the decorations, particularly the artistic pastel shades in the center of the ceiling.

"Who arranges all the decorations, Pop?"

"Mr. Kelly."

"Who put all these exhibits in here, Pop?"

"Mr. Kelly."

"Who takes them all out again, Pop?"

"Mr. Kelly."

"Who is the secretary of the N. R. A. A., Pop?"

"Mr. Kelly."

"Gosh, Pop, Mr. Kelly does a lot of things. How do you suppose he does them?"

"Mr. Kelly, my boy, is Irish."

Just then Rollo saw one of the exhibits which uses model trains in motion. He made a rush for it, but he had no show, being of small stature. There was too big a crowd around it. His Pop lifted him up, but soon Pop himself was so interested that he nearly dropped Rollo. Then they finally tore themselves away, only to see another one, followed by another and another. It wasn't long before Rollo saw the dozen or so moving picture exhibits in action. He rushed madly from one to another, followed by his Pop.

"Gee, Pop," he said at last, "I'm sorry there's only one of me."

"I'm not," said Pop, feelingly, "but why?"

"Well, here I am in a place where there are a dozen free movies and I can only see one of them at a time."

In an odd moment when Rollo was not attracted by the thousand and one things of interest, his roving eye rested upon an important and busy man.

"Who's that?" he inquired.

"Al Greenabaum, president of the N. R. A. A."

"Go on, Pop, you're kidding me, that man doesn't look like a section hand."

"Of course he doesn't Rollo, where in the world did you get such an idea."

"Well, in the picture in the *Railway Age* 'Conventionalities,' he looks like a section hand."

"Ah, my son, but that was many years ago, right after he came from Halifax."

"'Came from Halifax'," inquired Rollo, "don't you mean 'Go to Halifax'? That's what everybody else says."

"No, this is not the same Halifax. Mr. Greenabaum comes from Halifax, N. C."

They walked and walked and walked and stopped and stopped. Like most visitors, they found it difficult to pass up any booths. The flashing signal lights, the crossing gates going up and down, the house on fire, the pictures, all conspired to have them linger and like all visitors, they did linger. Every time they seemed to be making progress, they would see a cinder plant, a coaling plant, a ballast cleaner, a moving switch point or a dozen and one other things that would hold their attention. Like all small boys, Rollo was interested in tools, and his eyes fairly gleamed as he saw the array of picks, shovels, adzes, mauls and what not. Then too, he had to sit in every motor car, every track oiler, every spreader and every crane he saw and, it must be admitted, his Pop sat in them too.

At last they stopped before an active scene. Men were doing this, that and the other thing to a stretch of track.

"What are all those things, Pop?"

"There's a tie-tamper, a spike-driver and a spike-puller, all run from the same compressor."

"Say, Pop, does that machine cut the section men's hair too?"

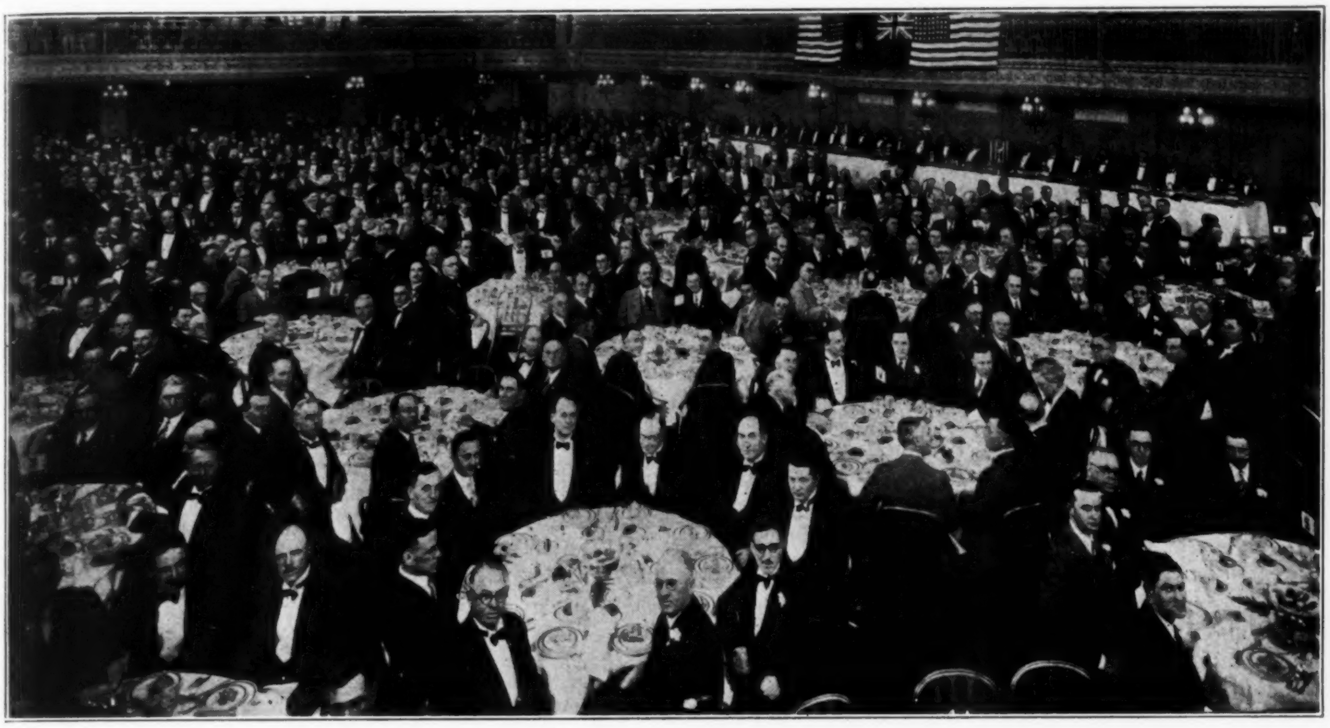
"No, my boy," replied Pop, with a smile, "but one might make a pretty fair job of cutting a section man's hair with that power hand mower across the way."

At last the time came to leave and they started out the entrance, only to have the watchful guardian tell them that the exit was at the other end of the building.

"My, gosh," said Pop, "that means another hour before I can get this kid by all those exhibits."

It did take an hour and more before he got the youngster past the exhibits and to the exit, but, to be honest, Pop enjoyed it as much if not more than his young hopeful did.

*Editor's Note.—Rollo looked over the show yesterday and his enthusiasm knew no bounds. Pop and the RAILWAY AGE representative tried hard to keep up with him, and it may be said here that they also enjoyed themselves.



Members of the A. R. E. A. and Their Guests at the Annual Banquet Last Night

A. R. E. A. Holds Successful Dinner

Annual event was attended by one thousand members and guests of the association

APPROXIMATELY 1,000 members and guests of the American Railway Engineering Association gathered in the grand ball room of the Palmer House last evening for the annual dinner, this being the most largely attended dinner in the history of the association. The evening was featured by the presentation of a token of esteem to President D. J. Brumley, as reported elsewhere in these pages, and by the presentation of a banjo clock to President-elect W. D. Faucette by the members of the Committee on Records and Accounts, as an appreciation of their long association with him on that committee.

President Brumley presided as toastmaster and introduced the speakers of the evening, L. A. Downs, president of the Illinois Central; John A. Rowland of the Toronto (Ont.) bar, and Herbert Leon Cope. An abstract of Mr. Downs' address and a brief review of Mr. Rowland's remarks are presented below. Mr. Cope's talk, to which he gave the title "Smiling Through," was in a lighter vein.

Mr. Rowland Emphasizes Value of Railways

Mr. Rowland told of the part the railways have played in this country and in Canada in furthering mutual understanding between the various widely-separated portions of this continent. He reviewed the major part that the Canadian Pacific played in bringing about the confederation of the Canadian provinces. He spoke of the furtherance of mutual understanding in the United States by the building of railways and facilitating means of communication.

He compared the United States and Canada as twin democracies, each working toward the ideal of good government. To obtain the truest form of democracy, he said, requires education on the part of the individual. Manifestly, in a country whose citizens have only a rudimentary knowledge of government, or no knowledge at all, the government will necessarily be bad. In educating the individual, the railways have been of inestimable value to their respective countries. As the means of transportation is facilitated, so is the knowledge of the individual extended, Mr. Rowland maintained. In acquainting individuals in the East with the thoughts, the problems and the spirit of individuals in the West, and vice versa, the railways have done much to promote that mutual understanding which is so necessary in producing the ideal democracy.

The friendly relations existing between the United States and Canada are also largely attributable to the ease of travel and communication, according to Mr. Rowland. In building up the close connections which exist between the railways of the two countries, conventions of this nature are extremely valuable. He pointed out the number of Canadians attending the convention, and called attention to the fact that it is by no means an uncommon occurrence for the executive officers of the A. R. E. A. and other railway associations to be selected from Canada, and for the associations

themselves to meet on Canadian soil. This too, is a valuable adjunct in promoting mutual understanding and mutual respect between the two countries.

The Place of the Railway Engineer

By L. A. Downs
President, Illinois Central

Twenty-eight years ago this month the first convention of the American Railway Engineering Association was held in this city. In the chair on that occasion was that eminent engineer, John F. Wallace, first president of the association, then assistant vice-president of the Illinois Central System. I am proud of the part my railroad has taken in this association, and I refer to it with pleasure. Among the 279 members reported at the first convention there were 30 Illinois Central men. We, and I say "we" because I was one of the 30, made up more than one-tenth of the original membership. We gave the association its first president. We have since then been represented by three other presidents, A. S. Baldwin, D. J. Brumley and myself. Three more men who laid the foundations of their reputations on the Illinois Central have sat in the president's chair—H. R. Safford, George Ray and L. C. Fritch. Thirteen Illinois Central men have served the association as committee chairmen from one to five years each; their total service as chairmen of committees amounts to 38 years. Finally, at no time since the association was organized has the Illinois Central not been represented on the board of direction. I believe every Illinois Central man who is here tonight shares my honest pride in that record.

L. A. Downs

Association Makes Great Contribution to Railway Engineering

The extensive scientific investigations made by our association through its various specialized committees, the exhaustive researches it has conducted, the fund of scientific data it has accumulated and made available, the conclusions it has reached and the recommendations it has made, all constitute what probably is the greatest contribution from any one source that has yet been made to the science of railway engineering. The recommended practices of this association have come to be accepted and applied in all parts of the world, and they are being extensively taught in technical schools here and abroad. That record shows perhaps better than anything else the position of recognized leadership enjoyed by our association.

What are the evidences of progress in railway transportation during approximately the last three decades? In 1900, when our association was just getting under way, there were 193,000 miles of railroad in the United States. Ninety-five per cent of this mileage had been built during the last half of the nineteenth century, in many respects the most extraordinary period of expansion in the history of this or any other country. During that period the chief problem of railway engineers was to get the rails down and get them down as quickly as possible. In a large part of the country, railway development went in advance of agricultural, mineral and industrial development, so that builders had few reliable indications of future progress to guide them. They could not possibly do more than guess at what was going to happen, what factors would cause one community to become a great industrial center and another to remain stationary or fall into decay. It was impossible for them to anticipate the economic trends that in later years were to cause one pioneer railroad to prosper and expand, and another road, once equally promising, to fall behind in the march of progress.

Roads Have Made Remarkable Progress in Efficiency

That the railroads, largely through the skill of their engineers, have met and mastered these problems is attested by the excellent physical condition in which we find the railroads today, and by their success in meeting the transportation needs of the country. There has never been a time when the railroads functioned as smoothly and as efficiently as they are functioning today; never a time when they were so fully prepared to satisfy our country's requirements for their service.

Since 1900 the population of the United States has increased approximately 57 per cent. In the same period the first-track mileage of the railroads of the country has increased only 30 per cent. However, the mileage of all railway tracks has increased more than 62 per cent. This is only one of the ways in which the railroads have grown. They have been making substantial progress in many other ways, as every railway engineer knows. They have added to their efficiency and capacity by revising alinements, by reducing grades, by using heavier rails and more ballast, by installing block signals, by strengthening bridges, by rearranging and reconstructing yard and terminal facilities, by installing more powerful locomotives and more capacious cars, and so on.

If railway expansion had merely kept pace with the growth in population, the railroads today would be entirely inadequate to meet the demands which are made upon them. Since the beginning of the century the transportation service required of the railroads has increased much faster than population has increased. In 1900 the railroads performed 1,856 ton-miles of freight service for every man, woman and child in the country; in 1926 they performed 3,791 ton-miles per capita. In other words, the per-capita requirement of transportation more than doubled in a quarter of a century, and on top of that the country's population grew from 76,000,000 to 117,000,000. The result of these increases is that the railroads of the United States in 1926 performed more than three times as much freight service and more than twice as much passenger service as in 1900. The ability of the railroads to handle such increases in freight and passenger business with an increase of only about 62 per cent in their total trackage is the result of greatly increased efficiency. The application of scientific engineering principles, such as those

I have mentioned, is chiefly responsible for that increased efficiency.

The revision of grades and alinements, the strengthening of bridges, the installation of heavier rail and other improvements have made it possible to operate longer and heavier trains on faster schedules, and have speeded up railway operation in various other ways. The designing loading for railway bridges has been increased approximately one-third since 1900. On lines where 75- and 85-pound rail was standard in 1900 we now have standards of 110- to 136-pound rail.

Remarkable progress has been made in the development and installation of more powerful locomotives. The number of locomotives owned by the railroads has increased only 67 per cent since 1900, but their aggregate tractive power has increased 240 per cent. The car capacity of the railroads, like their motive-power capacity, has also kept pace with the development of the country and with the increase in railway traffic. This has been accomplished partly by the addition of more cars and partly by increasing the capacity of the average unit. Since 1900 the number of cars owned has increased 62 per cent, but their aggregate capacity has increased 160 per cent.

By reason of increased capacity and greater efficiency in utilization the average freight car now performs 94 per cent more service than in 1900. If the average performance per freight car had been the same in 1926 as in 1900, the railroads would have required 2,200,000 more freight cars than they owned to have handled the 1926 traffic.

Patrons, Employees and Owners Benefit by Greater Efficiency

Developments in the efficiency of the railway plant, such as these I have just outlined, have enabled the railroads to benefit their patrons not only by keeping pace with but by forging ahead of the expanding volume of traffic. At the same time these developments have benefited railway employees by enabling them to earn and to deserve increases in pay. Although the railroads are now producing more than three times as much service as at the beginning of the century, the number of railway employees has increased only 75 per cent. The consequence is that each employee performed 269,033 units of service in 1926, on the average, as compared with 154,900 units in 1900.

And last, but not least, the prudence of the investment represented in these developments has enabled the railway owner to keep his head above water while battling the contending tides of reduced rates and increased operating expenses. Although railway investment has more than doubled during the life of our association, the investment in 1926 amounted to less than five cents for each unit of service performed that year, as against an investment of about 6½ cents for each unit of service performed in 1900. If the ratio of 1900 had been maintained in 1926, the amount of service performed in the latter year would have required an investment nearly seven billion dollars in excess of that actually recorded, and the problems of attempting to earn a return on the investment would have been considerably complicated. In view of the fact that the bulk of the extra investment would undoubtedly have been made through the issuance of bonds, bankruptcy would have been a whole lot nearer under those circumstances in 1926 than it actually was.

Future Challenges the Skill of Railway Engineers

The possibilities for continued improvement in the railway field are by no means near exhaustion. We are living in an age of great achievement. Science and experience are steadily extending the boundaries of our knowledge and disclosing additional leads for exploration and exploitation. Research workers here and abroad are constantly seeking new materials and better ways of producing and of utilizing materials already in use. Their work is being checked and supplemented by a multitude of tests and experiments carried on by experienced field men under actual service conditions. This great expenditure of thought and effort on the part of thousands of capable, enthusiastic technicians is bound to yield important results.

Such results are steadily forthcoming. Nearly every issue of publications devoted to railway engineering tells of some notable advancement. Almost any day may bring forth the news of some discovery that will revolutionize present practice in some branch of railway engineering and open up vast fields for further development. No one, of course, can foretell what the future has in store for us, but there is no question that it will continue to yield many new opportunities and new problems to challenge the skill of railway engineers.

In this connection, I think it is well to consider for a moment how the duties and responsibilities of the railway chief engineer of today compare with those of the chief engineer of the more pioneering days. We are accustomed to look back upon the early days of railway building as a period of romance and of real achievement, and to regard the builders of that time as a race of supermen to whom the conquering of almost overwhelming natural obstacles was the breath of life.

It is right and proper that we should reverence these men and applaud their achievements, for they laid our foundation and helped to plan our structure; but we must not forget that what may sometimes seem the most heroic kind of engineering may often prove to be also the simplest kind. The problem in the early days was to get the line in place, no matter how; "to get there firstest with the mostest men," as one Civil War general is reported to have said, regardless; and to provide service of a sort for a pioneer population that was so hungry for transportation of any kind that it could not afford to be, if indeed it knew how to be, particular. The result was that the end was frequently, in an engineering way, used to justify the means. Spectacular accomplishments were the order of the day, but at what expense of material and of ultimate economy we, the successors and heirs of the early engineers, must full well realize. In not all, but in many cases, "it was magnificent," as an observer remarked concerning the charge of the Light Brigade, "but it was not war."

Problems of Engineers are Greater Today

The chief engineer of today must meet and overcome what I firmly believe are, in their essence and potentialities, far larger problems than confronted the engineers of the earlier days. Today we must not only repair the mistakes of the past, but we must plan for the constantly expanding traffic requirements of the future, and we must do so without interfering with the smooth functioning of our present highly dependable and highly responsible transportation plant. We deal in larger figures and with more efficient tools than did our predecessors, but these things in themselves burden us with increased responsibility for their proper use.

The chief engineer of today, because he is more closely hedged in by the already constructed plant, as well as by custom, precedent and a much broader knowledge of the requirements as well as the possibilities of his subject, must proceed with greater caution than did

his predecessor of 50, 75 or 100 years ago. He must be surer in advance of what he is going to accomplish; he must be more confident of his plans and of his materials; he must proceed with care, testing constantly as he goes and drawing upon the costly lessons of experience that history and his own previous work have taught him.

Besides all this increased refinement in the technique of his work he must retain and apply intelligently the creative spirit that is perhaps the most valuable heritage of pioneer railway engineering. He must look ahead, see what can and should be done and remain constantly fertile in practical suggestions for the improvement and refinement of the property under his care. The management of the property must be able to rely upon him for voluntary and constructively profitable suggestions, retaining to itself merely the "yes" or "no" decision as to procedure and the details of financing the work. To these requirements, I believe, the chief engineers of today are constantly coming nearer to measuring up. As long as they retain such ideals of progressive achievement, I believe that the future of the railway plant, in so far as good engineering governs its capacity and efficiency, may be regarded as safe.

Experience shows that every improvement in railway methods and materials points the way to opportunities for further improvements; so the goal of perfection is never attained. The path of the railway engineer leads to constantly higher ground. As he travels onward, the horizon of his vision is extended; as he mounts to higher levels of achievement, his horizon lifts before him. The farther he goes, the more opportunities he discovers awaiting his skill and ingenuity. The only limit to the opportunities for railway engineers is the ability of the railroads to obtain the money needed to let the engineers exercise their talents.

Future Holds Many Opportunities for the Railway Engineer

The years immediately ahead of us ought to see great strides made in the accomplishment of betterments. The public is increasingly aware of its vital interest in having good railway service and of the intimate relationship between good service and the ability of the railroads to obtain money for continued expansion and improvement of their facilities. It is constantly becoming more generally appreciated that the expenditure of large sums of money for grade and alinement revisions, more efficient equipment and similar projects resulting in better service for the public cannot be expected from impoverished railroads. The trend of public sentiment is definitely in favor of encouraging railway progress by favoring railway prosperity. This constructive attitude on the part of the public promises well for the ability of the railroads to finance their improvement programs, so I believe, we are at the threshold of an era rich in opportunities for brilliant achievements in railway engineering.

We must comprehend the increased momentum of science and of social and economic progress in order to have the proper perspective of the possibilities of the future that confronts us as engineers. Readjustments of far-reaching importance are steadily taking place in transportation as in every other phase of modern life. The railroads must be constantly on the alert to anticipate these readjustments and to conform to them quickly in order to maintain their place in our national economic organization. Their task is to keep abreast—even a little in advance—of the times, and that is largely an engineering problem. Therein is assurance of rich fields of labor and of service for wide-awake, progressive railway engineers.

Tribute to President Brumley

A FEATURE of the annual dinner of the A. R. E. A. in the grand ball room of the Palmer House on Wednesday evening which was not announced in advance was the presentation of a silver cup to President Brumley by a number of his friends and brother members on behalf of the association. The cup bears the inscription:

Cup Presented to President Brumley

Presented to Daniel J. Brumley, President American Railway Engineering Association. Twenty-Ninth Annual Meeting, March, 1928.

The action was not only a fitting tribute to Mr. Brumley for his constructive work during his long membership in the association but is likewise an appreciation of the interest which the Illinois Central has always taken in the affairs of the A. R. E. A. John F. Wallace, the first president and at that time chief engineer of the I. C., was one of the most active workers in the formation of the association and in the outlining of the method of procedure which has been instrumental in the development of the A. R. E. A. to its present status. While the work during the formative period of the association was of the utmost importance, it would have gone for naught if it had not been carried on by the officers and members of later years and it is fitting that recognition should be given to these efforts from time to time.

* * *

Why Engineers Recommended Train Sheds in the Sixties

New A. R. E. A. Officers Chosen

Results of election announced at close of yesterday afternoon's session after tellers count ballots

AS IN past years the results of the annual election were announced at the close of the afternoon session on Wednesday. The officers elected were as follows:

President, W. D. Faucette, chief engineer, Seaboard Air Line.

Second vice-president, G. D. Brooke, general manager, Chesapeake & Ohio.

Treasurer, F. J. Stimson, assistant chief engineer maintenance of way, Pennsylvania, Western Region.

Secretary, E. H. Fritch, A. R. E. A.

Directors: A. N. Talbot, professor of municipal and sanitary engineering, University of Illinois; Hadley Baldwin, chief engineer, Cleveland, Cincinnati, Chicago & St. Louis; and F. E. Morrow, assistant chief engineer, Chicago & Western Indiana.

Nominating Committee: T. T. Irving, chief engineer, Central Region, Canadian National; F. W. Green, vice-president, St. Louis Southwestern; Maro Johnson, assistant engineer, Illinois Central; W. A. Clark, assistant to general manager and chief engineer, Duluth & Iron Range; and R. C. Bardwell, superintendent of water service, Chesapeake & Ohio.

In addition, Louis Yager, assistant chief engineer, Northern Pacific, second vice-president, automatically becomes first vice-president.

Louis Yager
First Vice-President

W. D. Faucette
President

G. D. Brooke
Second Vice-President

W. D. Faucette, President

In W. D. Faucette the association has elected for its president the first representative of a southeastern road, one who, by reason of nativity, education, experience and personal attributes, is truly representative of the South. He was born at Halifax, N. C., was educated at North Carolina State College and has seen 27 years of service with a southern road—the Seaboard Air Line. His training as a railway engineer is typical of that of the engineering officers of these times, save for the fact that he was afforded an opportunity to obtain a broader grasp of the fundamentals of railway transportation in the course of some three years of service as chief clerk to the president of the Seaboard Air Line just previous to his advancement to chief engineer in 1913.

Little given to extensive reading outside of his chosen field because of the exacting demands which he makes upon his time for a conscientious study of the problems arising in his work, he finds diversion when opportunity affords in vacation travel. His devotion to his family is such that he makes little use of the several clubs to which he belongs and indulges in but few of the popular pastimes of the day. Nevertheless, he is a man who derives great satisfaction and inspiration from social contacts. In fact, he is a living demonstration of Theodore Roosevelt's apt explanation of a "pleasing personality," namely, that it is nothing more than a reflection of a keen and sincere interest in others. Mr. Faucette derives a special pleasure in meeting people, particularly those who bring him new ideas or new points of view, and since he is himself a brilliant conversationalist, he is always in a position to profit by these contacts. Added to these attributes, he possesses a marked ability as a public speaker, an accomplishment which leads to extensive demands on his time because of the frequency with which he is called upon to represent his railway in public addresses.

Mr. Faucette's advancement to the presidency of the A. R. E. A. comes after the customary period of service as vice-president and director. In his participation in committee work he has been identified with the Committee on Uniform General Contract Forms of which he was a member for 10 years, during 6 of which he was chairman.

A. R. E. A. Registration

A TOTAL of 272 members and 122 guests registered yesterday, bringing the total for the first two days of this convention to 916 members and 311 guests, a combined total of 1,227. This compares with a similar registration for the first two days of last year's convention of 892 members and 321 guests, or a combined total of 1,213 and a registration of 783 members and 177 guests, or a combined total of 960, in 1926.

Alphabetical List of Members

A

Abbott, A. T., supt., C. R. I. & P., Des Moines, Ia.
Alden, C. A., chf. engr., Bethlehem Steel Co., Steelton, Pa.
Anderson, B. T., asst. to vice-pres., Union Switch & Signal Co., Swissvale, Pa.
Anderson, Irving, div. engr., A. T. & S. F., Kansas City, Mo.
Anderson, J. P., div. engr., N. C. & St. L., Atlanta, Ga.
Armistead, F. W., roadmaster, I. C., Mattoon, Ill.
Armstrong, A. W., pres. & mgr., Ayer & Lord Tie Co., Chicago.
Armstrong, S. E., engr. of stand., N. Y. C., New York City.

B

Baker, J. B., chf. engr. maint. of way, Penna., Pittsburgh, Pa.
Baker, William E., supvr., Penna., Cleveland, O.
Baldwin, R. A. engr. con., Can. Nat., Toronto, Ont., Can.
Baldwin, Hadley, chf. engr., C. C. C. & St. L., Cincinnati, O.
Baldwin, L. W., pres., M. P., St. Louis, Mo.
Bardo, B. F., supt. of elec. transm., N. Y. N. H. & H., West Haven, Conn.
Barry, G. R., supt., Penn., Richmond, Ind.
Basye, E. M., res. engr., K. C. S., Kansas City, Mo.
Batchellor, F. D., div. engr., B. & O., Garrett, Ind.
Bates, F. E., bridge engr., M. P., St. Louis, Mo.
Bell, G. A. W., Jr., maint. inspr., B. & O., Pittsburgh, Pa.
Bell, Gilbert J., engr. east. dis., A. T. & S. F., Topeka, Kan.
Bertenshaw, B. A., val. engr., C. C. C. & St. L., Cincinnati, O.
Bevan, W. H. B., asst. dist. engr., C. N. Toronto, Ont.
Biggs, W. T., asst. engr., C. & A., Bloomington, Ill.
Blaess, A. F., chf. engr., I. C., Chicago.
Bock, E. L., gen. supt., C. & O., Huntington, W. Va.
Boland, W. E., sig. engr., S. P., San Francisco, Cal.
Bousfield, Alfred, chf. engr., E. & T. Fairbanks Co., St. Johnsbury, Vt.
Bradley, A. C., div. engr., C. R. I. & P., Rock Island, Ill.
Breed, Chas. W., engr. of standards, C. B. & Q., Chicago.
Bridgman, J. N., asst. engr., A. T. & S. F., Topeka, Kans.
Briggs, Z. M., asst. engr., Penna., Pittsburgh, Pa.
Brown, P. M., engr.-acct., M. P., St. Louis, Mo.
Brunner, John, mgr. dept. of metlgy., Illinois Steel Co., Chicago.
Bryan, C. G., asst. engr., I. C., Chicago.
Burg, W. A., asst. engr., C. C. C. & St. L., Springfield, O.
Burnett, W. S., chf. engr. of construction, C. C. C. & St. L., Cincinnati, O.
Burt, J. W., div. engr., C. C. C. & St. L., Indianapolis, Ind.

C

Carpenter, Wm., supvr., B. & O., Garrett, Ind.
Carter, H. K., asst. div. engr., C. C. C. & St. L., Mattoon, Ill.
Caruthers, E. W., asst. engr., Penn., Philadelphia, Pa.
Casey, Robert W., asst. chf. draftsman, C. & N., Chicago.
Cathers, Charles P., Jr., instrumentman, M. P., Texarkana, Tex.
Chamberlain, O. P., vice-pres., Dolese & Shepard Co., Chicago.
Chinn, Armstrong, engr. maint. of way, C. B. & Q., Lincoln, Nebr.
Clark, A. M., div. engr., N. Y. C. & St. L., Ft. Wayne, Ind.
Clark, H. A., gen. mgr., M. & W., Muncie, Ind.
Clark, W. A., asst. to gen. mgr. and chf. engr., D. & I. R., Duluth, Minn.
Clarke, H. R., gen. insptr. perm. way & structures, C. B. & Q., Chicago.
Clement, S. B., chf. engr., Temiskaming & Northern Ontario Ry. Co., North Bay, Ont., Can.
Clevenger, T. R., asst. div. engr., C. C. C. & St. L., Indianapolis, Ind.
Collette, E. L., div. engr., St. L.-S. F., Fort Smith, Ark.
Collinsworth, J. R., asst. engr., I. C., Chicago.
Copeland, R. D., asst. engr., Ann Arbor, Owosso, Mich.
Cramer, W. N., supvr., I. C., Freeport, Ill.
Cross, Hardy, prof. of structural engineering, University of Ill., Urbana, Ill.
Crowe, S. N., div., engr., Wabash, Moberly, Mo.
Culp, C. B., asst. engr., C. & W. I., Chicago.

D

Darrow, F. T., asst. chf. engr., C. B. & Q., Lincoln, Neb.
Davies, W. P., asst. engr., M. P., St. Louis, Mo.
DeLamater, B. E., asst. engr., C. C. C. & St. L., Galion, O.
Dennis, Walt, supt. N. J. I. & I., South Bend, Ind.
Dickey, H. B., instrumentman, M. P., Nevada, Mo.
Dodgson, F. L., con. engr., General Railway Signal Co., Rochester, N. Y.
Dorley, A. F., prin. asst. engr., M. P., St. Louis, Mo.
Duffy, C. M., asst. sig. engr., C. R. I. & P., Des Moines, Ia.
Dunn, M. I., Jr., asst. div. engr., C. & O., Huntington, W. Va.

E

Eck, W. J., asst. to vice-pres., Southern, Washington, D. C.
Edwards, John, Jr., asst. engr. maint. of way & struc., B. & O., Pittsburgh, Pa.
Ellis, B. C., asst. engr., I. C., Louisville, Ky.
Elsworth, R. B., asst. sig. engr., N. Y. C., Albany, N. Y.

F

Fanning, J. E., dist. engr., I. C., Waterloo, Ia.
Farlow, G. B., div. engr., B. & O., West, Grafton, W. Va.
Faus, H. W., engr. of tests, N. Y. C., New York City.
Feagin, Geo. W., locating engr., L. & N., Louisville, Ky.
Fergus, J. L., div. engr. N. C. & St. L., Chattanooga, Tenn.
Fisher, R. B., vice-pres., Buda Company, Harvey, Ill.
Fithian, W. R., instrumentman, M. P., Osawatomie, Kans.
Freeberg, Solomon, asst. engr., M. P., Maplewood, Mo.
Frick, O. H., supt. C. M. S. P. & P., Portage, Wis.
Fulweiler, W. H., chem. engr., Philadelphia, Pa.

G

Gabriel, R. W., div. engr., B. & O., Newark, O.
Gamble, J. S., supvr., Wabash, Moberly, Mo.
Gault, Paul M., sig. engr., M. P., St. Louis, Mo.
Geis, R. L., asst. engr., C. C. C. & St. L., Springfield, O.
Gersbach, Otto, chf. engr., C. J., Chicago.
Gilmore, R. W., asst. div. engr., B. & O., Chillicothe, O.
Gonsar, P. E., master carp., Penna., Chambersburg, Pa.
Graham, F. M., engr. maint. of way, Penna., Cleveland, O.
Gravelle, R. A., asst. engr., C. N., Detroit, Mich.
Grear, S. F., asst. engr. brdgs. and bldgs., I. C., Chicago.

H

Hadley, E. A., chf. engr., M. P., St. Louis, Mo.
Hale, H. E., vice-chairman, Eastern Group, Presidents' Conferference Committee, New York City.
Hanger, K. H., engr. maint. of way, M. K. T., Dallas, Tex.
Harting, O. F., asst. chf. engr., Term. Railroad Assn. of St. Louis, St. Louis, Mo.
Hartzell, I. L., div. engr., K. C. S., Kansas City, Mo.
Harvey, A. D., asst. chf. engr., Kansas City Bridge Co., Kansas City, Mo.
Hastings, Clive, vice-pres., Locomotive Finished Material Company, Atchison, Kan.
Hawkins, E. P., div. engr., M. P., Osawatomie, Kans.
Haywood, A. E., asst. engr., G. T. W., Battle Creek, Mich.
Hazlewood, W. G., div. engr., St. L.-S., Jonesboro, Ark.
Heimerdinger, W. E., div. engr., C. R. I. & P., Cedar Rapids, Ia.
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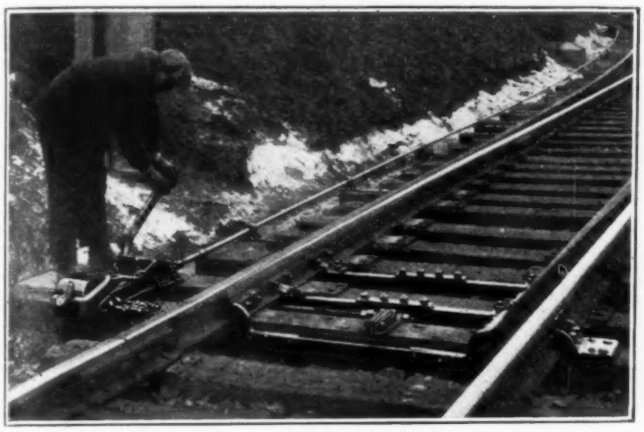
Style-T10 Hand-Thrown Switch and Lock Movement

THE Union Switch & Signal Company has placed on the market a new hand-operated switch movement and circuit controller. The new switch movement is adaptable for use in operating a single switch, a switch and a derail, or switches at cross-overs between the main tracks and sidings, and also provides for locking the switches in the normal positions.

The movement consists of a throwing lever, pivoted on a shaft located about the mid-point of the movement. On this shaft is a segmental gear which engages a toothed rack directly under it. On the under side of the rack is a groove into which a roller-enclosed stud



Installation View of Switch and Lock Movement

enters from the throwing crank. The throwing crank is pivoted in a vertical bearing in the bottom of the mechanism case. The throw rod of the switch is connected to that portion of the crank outside and underneath the case. The switch-operating crank is operated by the movement of the motion plate, through the engagement of the roller on the crank with the cam face on the motion plate.

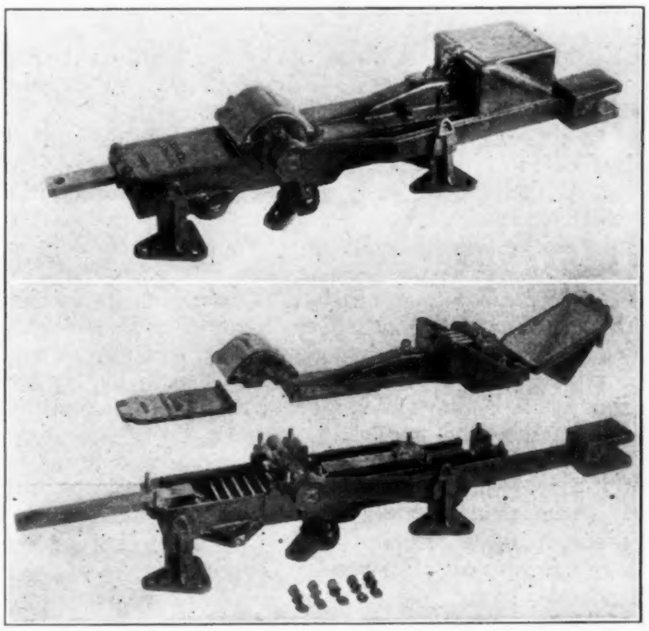
On the lock box end of the motion plate rack, a stud is provided so that a rectangular lock-bar may be slipped over it. At the other end of the motion plate are attached the necessary pipe connections for operating a second movement. Another arrangement omits the short rectangular lock-bar and its operating stud, and substitutes a rectangular lock-bar extending the length of the movement. This latter arrangement provides a movement in which the unlock of the switch is accomplished independently of the throwing lever. Applications of such nature may be made use of at a main line crossover by connecting the rod in each movement to a separate unlock lever stand at the mid-point of the crossover.

On the crossover between the main and side tracks, a movement having a combined lock-bar and motion plate may be used at the main line end, and at the other end a movement having an independent lock-bar. By connecting the independent lock-bar in the siding movement, it is necessary to reverse the main line movement *first,* and restore it *after* the siding movement is returned to normal. A circuit controller can be incorporated in the main line movement and operated from a dog on the lock-bar in this movement. Thus the main line track circuit is shunted before either pair of switch points is open. On the normal move, the contacts in such a controller are not opened until both movements are locked in the normal position.

The independent lock-bar is so arranged that when it is in the normal position, it not only locks the points of the switch but also engages a lug on the segmental gear so that this gear, and therefore the throwing handle, cannot be operated. Thus the independent lock-bar locks both the throwing handle and the switch points. When the independent lock-bar is in the lock position, and the switch is reversed, the lock-bar cannot be restored to normal until the switch points are normal, as the lock rod of the switch prevents the end of the bar in the movement from entering the lock box.

The movement has been designed for the highest degree of simplicity and ruggedness. All the parts, except the retaining pin for the switch-operating crank, may be reached from the top. This pin is held in place by a cotter, and must be withdrawn before the crank can be slipped off the square shaft extending below the box. Because of the severe service conditions to which the movements are subjected, large bearings fitted for pressure lubrication have been used. Square shafts have been used to avoid any keys or tight pins that might shear or work loose under severe vibration. It is possible to dismantle the entire movement while it is bolted to the ties. The operating crank is of forged, open-hearth steel, the segmental gear is of malleable iron and the motion plate is of semi-steel. The cases of both the movement and circuit controller as well as all covers are gray iron castings.

The circuit controller for this movement is usually provided with four sets of contacts arranged to close at all times except when the switch is locked in the normal position. It is possible to obtain any normal open or closed requirements of contacts, within the capacity of the box, by reversing the contact springs. In



View of Parts and Assembled Switch and Lock Movement

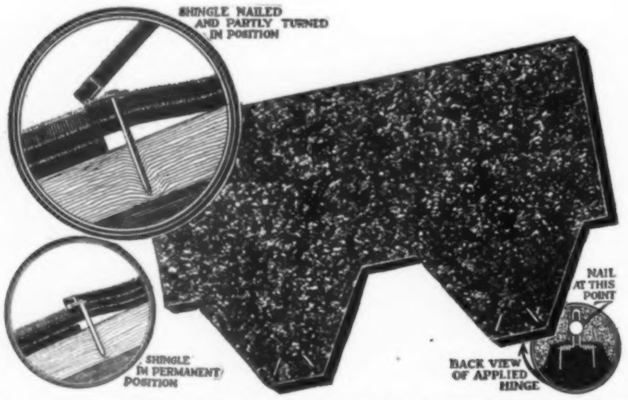
the base of the circuit controller is an extension that serves as a cover for the lock-bar so that when it is installed on a movement, the cover casting which would otherwise be used is unnecessary. All connections are brought into the circuit controller from underneath and are therefore out of the way of dragging equipment from passing trains.

This movement is simple in its operation, construction and maintenance. The operation of one lever throws and locks the switch, and if desired, shunts the

track circuit or provides selection for the signal circuits. Since only one pipe line is required for operating and locking one switch and derail or a crossover layout, an economical installation results. It provides a simple, rugged, and flexible layout, and increases the safety of train operation for hand-thrown switches.

The Mule-Hide Storm-Safe Shingle With Hinged Lock

THE Lehon Company, Chicago, has developed and introduced an asphalt shingle which it calls the Mule-Hide Storm-Safe, and which it designed with a hinged copper lock to permit each shingle to be nailed securely to the roofing board at the butt with a copper nail and also to be locked to the adjacent shingles in such a way that the locks and nails are covered in the finished roof, this design preventing the



The Storm-Safe Shingle, Showing Method of Application

shingles from being blown up by the wind or curling, and thus protecting the roof by precluding the entrance of rain or snow between the shingles.

In applying the shingles the nail is driven through the leaf of the hinge and the shingle is then turned back into position, completely covering the nail and hinge, which are made of copper to prevent deterioration by corrosion. The shingles are 32 in. wide by 20½ in. long and are laid with an exposure to the weather of 6⅝ in. and with a lap of 6⅞ in., thus providing a double thickness over the entire roof and a triple thickness over somewhat more than 50 per cent of the roof area. Sixty-eight shingles weighing 210 lb. will lay one square of roofing and it is said that their construction and method of application render them self-alining and easy to lay. The shingles are made with an all-rag felt base, impregnated with a high melting point asphalt, and are faced with crushed slate. It is said that their design permits them to be laid in either hot or cold weather with no injury to the shingles.

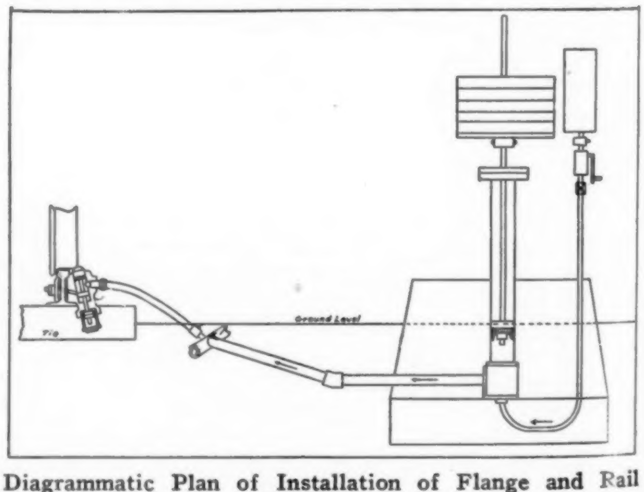
A New Flange and Rail Lubricator

AFTER a service test of about one year, the American Valve and Meter Company, Cincinnati, Ohio, has put a new track oiling device on the market, designed to minimize wheel flange wear and rail wear on curves, without the disadvantage and expense attendant on the hand application of lubricants. This new device, which is known as the Umholtz wheel flange and rail lubricator, differs from other forms of lubricators in use at the present time, and, aside from its effectiveness in accomplishing the desired results, it has the added advantage that a single installation can be arranged to lubricate either single or multiple track.

In arrangement, the Umholtz lubricator, which employs grease rather than oil as a lubricant, consists of two distinct parts, an application unit and an oil storage and supply unit. The former is affixed to the high rail of a curve, and is connected to the latter unit, which is located clear of the track along the roadway, by means of a pipe and flexible hose connection. Briefly, the storage and supply unit of the device consists of a storage tank of from 15 to 25 gal. capacity, directly connected through a small diameter pipe to a vertical supply or pressure cylinder from which grease is forced to the feed line. When the storage tank is filled with grease, the supply cylinder is charged by means of a hand pump in the supply line which fills the cylinder against the pressure of a weighted piston. When fully charged, a ball check valve in the supply line prevents the back flow of the grease.

In the supply cylinder, which can be furnished in various sizes, the weighted piston referred to causes a pressure of 45 lb. per square inch upon the grease, or greater as desired, and forces it through a buried feed pipe to within a few feet of the rail where it joins with a flexible section of hose leading to the application device.

This latter device consists of a casting block bolted to the outside of the rail, containing a small plunger and valve arrangement which is actuated by the contact pressure of passing wheel treads. In supplying the grease to the rail, a ¼-in. pipe is passed through a drilled hole in the rail web and is joined with a ¼-in. hole which is drilled diagonally through the ball of the rail, opening out on the curve of the rail head between the gage side and tread surface. Through the valve and plunger arrangement provided, the



Diagrammatic Plan of Installation of Flange and Rail Lubricator

grease is forced through this opening only as the plunger is actuated by passing wheels.

One of these applying devices is sufficient on short curves, but on longer curves or in generally curved track territory, two or more of the devices are applied several feet apart, all having direct connection with the supply cylinder through an underground manifold pipe, which is joined to the main feed line. For application in double or multiple track layouts,

it is necessary only that the feed line be extended to the high rail of each track and connected to applying devices similar to the unit described.

The advantages claimed for the new lubricator, aside from its principal function of reducing rail and flange wear, are that it saves a large amount of labor over brush and other hand methods; it is particularly suited to multiple track layouts; it is economical to install and to operate; it is fully protected against dirt and water which cannot affect its operation, and of large importance, the use of a heavy grease, rather than oil, makes it effective over a greater territory.

The Improved Lundie Tie Plate

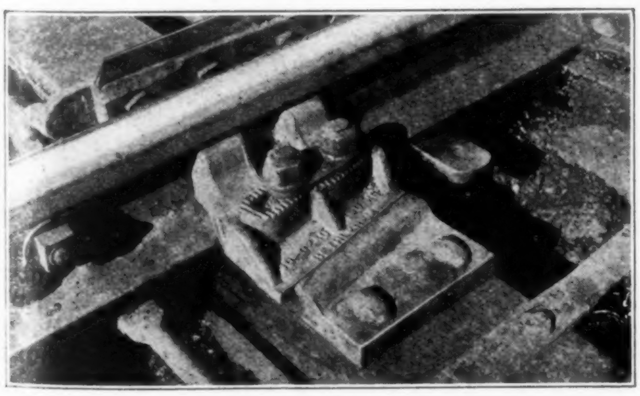
THE Lundie Engineering Corporation, New York, has introduced the Improved Lundie Tie Plate which embodies the same features as the former Lundie plate but which has been modified by additional

The New Lundie Tie Plate

steps on the bottom of the plate, thus giving increased holding power without injuring a single fibre of the tie.

The Improved Bethlehem Adjustable Rail Brace

THE IMPROVED adjustable rail brace for split switches on heavy duty tracks, which has been developed and introduced by the Bethlehem Steel Company, Bethlehem, Pa., performs the function of a slide plate as well as of a brace which can be adjusted



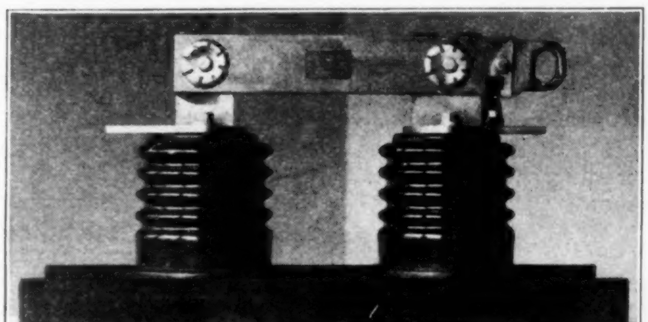
The Bethlehem Adjustable Rail Brace

quickly and locked in position. The slide plate is made of heavy rolled steel with a recess machined to form the rail seat about midway of its length. At the outer end of the plate, a shoulder set at a slight angle with the rail seat extends across the plate to permit the adjustment of the brace, which is a malleable casting shaped to fit the web and base of the rail, with a bottom flange extending outward to engage the shoulder. The edge of the flange has the same angle with the face of the brace as the shoulder, thus forming a wedge which permits close adjustment of the rail. The brace is held in the desired position by two bolts which extend upward through slots in the brace and a serrated washer which is interposed between the nuts on the bolts and the top of the shoulder, and which has serrations to match those of the washer. The bolts have countersunk heads, thus providing a smooth surface for the underside of the plate and eliminating the necessity of making recesses in the tie for the bolt heads.

Disconnecting Switches for High-Voltage Power Lines

THE NEW Westinghouse Type-H indoor and Type-RW outdoor disconnecting switches are used primarily for isolating apparatus from a circuit for purposes of inspection and repair; also for sectionalizing feeders or opening all phases of a transmission line at one time. In connection with lightning arrester installations, disconnecting switches are particularly useful, providing a simple and effective means for isolating the arresters for inspection and maintenance.

The Type-H switch is a heavy duty indoor unit, designed to withstand stresses between conductors, and heavy short circuits. This standard duty switch can be furnished for 2,500 to 73,000 volts. Some of its dis-



Westinghouse High-Voltage Disconnecting Switch

tinctive features are: the use of insulators of maximum striking distance, maximum mechanical strength, high flashover value and high factor of safety. Furthermore, insulator assemblies can be easily and quickly replaced if damaged. Sturdy bases are used that are light but strong and that assure proper contact alinement. They are easy of application to a wall or to a structural mounting in either the vertical or horizontal position. A positive latch is incorporated, designed especially for hook-stick operation. A split or parallel-path type of blade is used.

The Type-RW, outdoor, air-break, remote-control, gang-operated switches are for higher voltage lines and are applicable for use as plain disconnects for isolating apparatus and when operated, open all phases at one time. They are particularly designed for interrupting small branch circuits, for breaking line charging current and transformer magnetizing current. Arcing horns are furnished with all upright mounted switches and may be discarded if not required. Single, double and

three-pole switches are obtainable in voltages from 7,500 to 73,000. All switches of the above voltages are made in 400 and 600 amp. capacities. The split blade form of contact has been used on the 7,500- and 15,000-volt switches, and for all others the contact is of flexible self-alining and self-closing finger construction.

New Binks Paint Spray Equipment

AMONG the new devices recently developed and introduced by the Binks Spray Equipment Company, Chicago, for the expeditious and economical application of paint or other coating materials by the spray method are an extension gun and pressure containers equipped with air motor agitators and pressure regulators.


The Extension Arm in Use

The extension gun is designed to permit painting without scaffolds where long reaches are required. The extension arm is a single tube six feet long, through which both air and material are supplied to the nozzle, which is built especially for this unit. The tube, which is light in weight, has an operating control grip at the base of the arm and an adjustable grip for guiding the gun. The air and paint hose leading from the pressure container are attached to standard threaded connections on the lower end of the arm to afford a low center of gravity and thus to permit easy manipulation of the extension arm.

The pressure containers are made in various capacities and each is fitted with control heads with agitators driven by an air motor to insure the thorough agitation of the paint

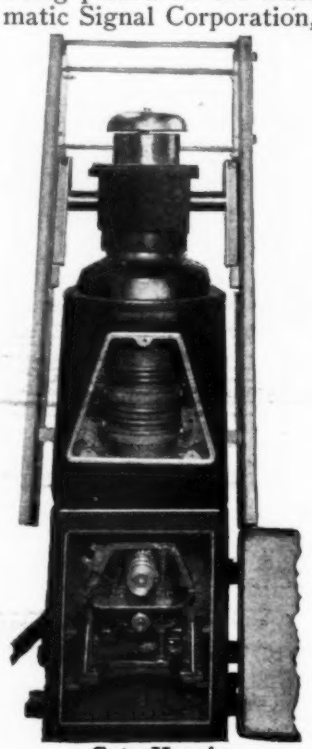

Container with Agitator and Pressure Regulators

to prevent segregation of the pigments and liquids of the paint. The air motor has a control valve by which the speed of the agitator may be regulated as required.

These pressure containers are made in different designs, one of which has two pressure regulators, one to govern the flow of material and the other to control the atomizing pressure. A similar arrangement for containers serving two guns has the regulator for the flow of material and an individual regulator for controlling the atomizing pressure for each gun.

The Standard Automatic Signal Crossing Gate

THE OPERATING mechanism for an automatic electric highway crossing gate invented by O. L. Vincent, Chicago, and previously referred to in the *Railway Age* of December 31, 1927, page 1334, has been improved and the gates are now being placed on the market by the Standard Automatic Signal Corporation, Chicago. In its improved form it is said that this signal is being used on both steam and electric railway crossings. The basic principle of this device is a gate arm so hung as to be easily movable in any direction. This permits automatic control by track circuits, since no damage is done to cars if the gate is lowered on them or directly in front of them. This gate is not broken by a car running through it and it will return to the normal position as soon as the car has passed. This loose support for the gate has other advantages such as the provision made for sleet load and heavy winds.

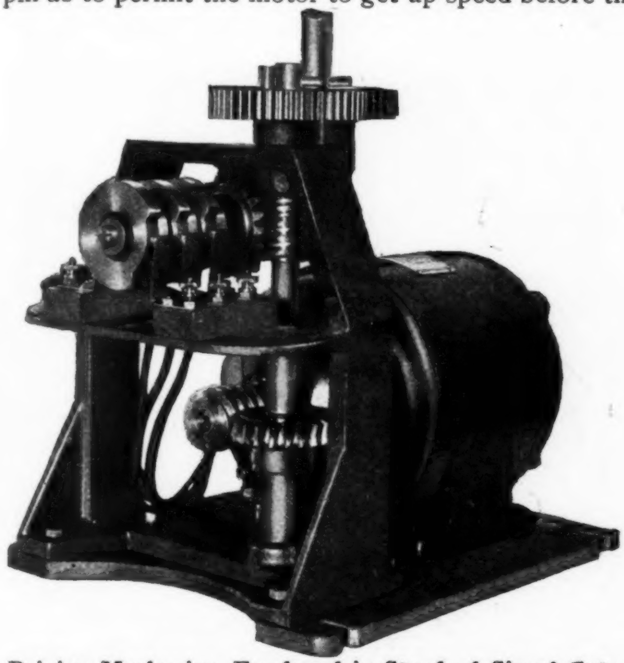

Gate Housing

In addition to the gate arm which lowers across the highway on the approach of the train the device includes a warning, consisting of a bell that rings and visual signal lights that may be seen down the highway in both directions. The lights are operative as long as the train is in the block but the bell rings only during the downward movement of the gate.

Each unit comprises the gate, the lights and bell, the operating mechanism and a dust and water-tight case serving both as a housing for the mechanism and as a support for the gate. The unit is firmly supported on a concrete foundation. The power drive assembly consists of a ¼-hp. Westinghouse reversible motor, driving a vertical shaft through a worm gear. The circuit controllers are mechanically operated by this shaft. The adjustment of these controllers is made by simply loosening the set screw, turning the contact segment and again tightening the screw. On a four-gate installation, where it is desired to have the two approach gates drop first, a fourth segment can be added on one of these mechan-

isms, which will close a relay circuit operating the other two gates at a pre-determined time after the first gates have closed.

A 4-in. spur gear fitting loosely over the upper end of the vertical drive shaft is so engaged by a driving pin as to permit the motor to get up speed before the load comes on. This spur gear meshes with a second gear similarly mounted, which is secured to the bottom of another vertical shaft which extends up through the gate head and operates a transverse shaft by means of a second worm gear. Pinions on the ends of this upper transverse shaft mesh with the rack that the gate hangs on. The bell is operated mechanically by a trip in the gate head, so arranged that it rings only when the shaft is turning in the direction to operate the gate downward.



Driving Mechanism Employed in Standard Signal Gate

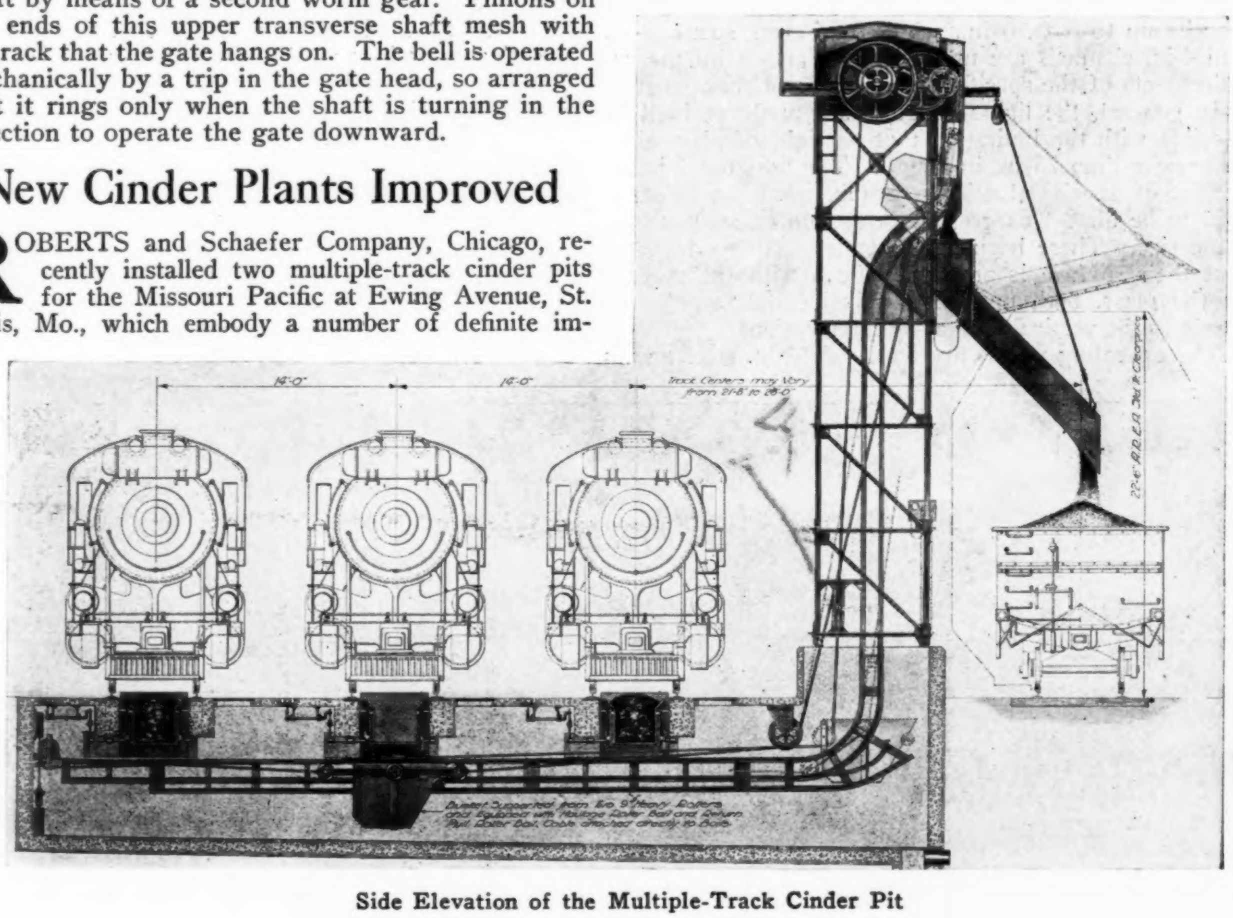
New Cinder Plants Improved

ROBERTS and Schaefer Company, Chicago, recently installed two multiple-track cinder pits for the Missouri Pacific at Ewing Avenue, St. Louis, Mo., which embody a number of definite improvements in facilities of this class. The plants are of the N. & W. type which this company has previously applied to multiple track installations, and while many of the mechanical details are the same or similar to those employed in older plants, the new pits are distinctive in several respects.

Foremost among the improvements is the employment of a vertical hoist tower, thereby permitting a closer spacing of the cinder car track and the nearest locomotive track. In this design the spacing of these tracks may be reduced to 21 ft. 8 in., but can also be increased to 26 ft. if desired. The use of the vertical tower also affords the full standard structure clearance adopted by the A. R. E. A., the pivoted ash and loading spout clearing the base of rail of the cinder car track 22 ft. when in the raised position.

The change from the inclined to the vertical tower was made possible by the adoption of an ingenious form of suspended bucket that is supported when traversing the tunnel or pit under the tracks by two flanged chilled iron rollers, 9 in. in diameter, which travel on a track consisting of 4-in. by 4-in. by ½-in. steel angles. This track is continuous with the roller guides in the tower which direct the travel of these rollers as well as those on a lifting bail from which the bucket is suspended during the vertical movement in the tower and the rollers of a pull-back bail.

The bucket is hauled and hoisted by means of a General Electric motor-driven hoist installed in a steel plate housing at the top of the tower. The hoist is equipped for automatic operation and is controlled by standard safeguards with a call push button to stop the bucket at the hopper under any track selected. The hoisting and lowering operations are effected by a single rope, continuous from the point of attachment on the lifting



Side Elevation of the Multiple-Track Cinder Pit

bail to a similar connection on the back-haul bail, slack in the cable being taken up by a weighted tension carriage at the far end of the pit.

The bucket receives the ashes from shallow track hoppers which hold 80 cu. ft. of cinders. These track hoppers are of cast iron construction and are provided with undercut gates which are operated by hand from a lever handle extending through the concrete roof of the pit, but the gates are interlocked in such a way that they cannot be dumped unless the bucket is spotted accurately beneath the track hopper.

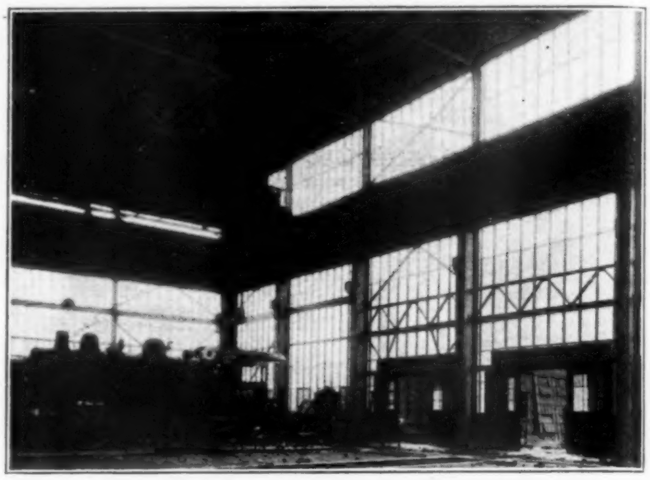
An incidental advantage of the improved design is a reduction in the clear headroom required for the cinder pits by reason of the use of the suspended type of bucket. The height of the pit is only 8 ft. from the floor to the base of rail of the locomotive tracks, thus simplifying the problem of adequate drainage. The pit is of reinforced concrete throughout, including the girders that support the track rails. This type of plant is adapted to installations serving from one to six tracks and it is said that the single bucket traveling at a rate of only 50 ft. per min., will elevate cinders faster than they can be dumped from six locomotives.

The Robertson Side Wall Sash

THE Robertson structural side-wall sash construction, which has been developed by the H. H. Robertson Company, Pittsburgh, Pa., consists of vertical load-carrying members attached rigidly at the top and bottom to the girt framing of steel buildings or to the lintels and sills in the case of brick wall construction. The bars are ordinarily spaced 24 in., center to center, although when necessary, this spacing may be varied to meet odd size openings. Each bar is proportioned in size to provide a limiting deflection factor of 1/30 in. per foot of span, angles being used for span lengths up to 8 ft. 6 in., while for longer spans, 3-in. and 4-in. channels are used in accordance with the requirements of the specified wind load and span lengths.

In general, the lights of glass are made as high as possible with the limitation that no light of glass shall be greater than 75 in. in length. The horizontal joints consist of special aluminum members with a strength said to be almost as great as a section of steel of the same size. These horizontal members are so designed that their surface is practically flush with the surface of the glass, both outside and inside and are bolted firmly to the vertical bars at all intersections.

The operating panels are made of 1/8-in. steel angles and consist essentially of a fixed frame and an operating frame which is weather-tight, the size being such that they may be inserted in the space left by the removal of a panel of glass 23¼ in. wide by 48 in. high. The frames may be operated in multiple with a bell crank operating device, or individually by means of a cam latch and chain. In applying the glass, an asphaltic



The Robertson Side Wall Sash

felt strip is applied directly to the 1½-in. flange of the sash bar against which the glass is bedded, and the top edge of the glass is then covered with a similar strip. The glass and cushion strips are held firmly against the bars by means of a sheet-metal cap member and fluted shoulder bolts on 12-in. centers with the bolt heads on the inside of the glazed flange of the sash bar. The grooves in the aluminum cross member are so designed that a glass may be set into position and then released temporarily to allow the outside of the glazing strip and the cap member to be applied. The cap members are spliced at each cross bar so that the individual light of glass may be removed at any time by simply removing two adjacent caps.

This arrangement permits the replacement of broken panes quickly and at small cost since no putty is used. The narrow horizontal spacing bars and vertical member admit light through approximately 94 per cent of the area occupied by the sash and the glass, while the small projection of the sash from the glass permits the latter to be cleaned readily over its entire surface with a squeegee without leaving dark or murky corners.

Ten Years Ago—American Railway Engineers Laying Track Under Fire. Note Where Shots Have Just Hit